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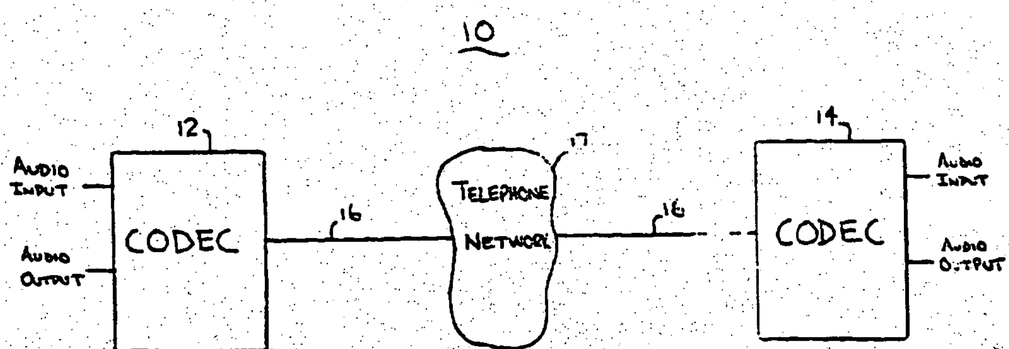

(57) Abstract

A digital audio transmitter system (10) capable of transmitting high quality, wideband speech over a transmission channel with a limited bandwidth such as a traditional telephone line (16). The digital audio transmitter system (10) includes a coder (32) for coding an input audio signal to a digital signal having a transmission rate that does not exceed the maximum allowable transmission rate for traditional telephone lines and a decoder (40) for decoding the digital signal to provide an output audio signal with an audio bandwidth of wideband speech. A coder (32) and a decoder (40) may be provided in a single device (12) to allow two-way communication between multiple devices.

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METHOD AND APPARATUS FOR TRANSMITTING CODED AUDIO SIGNALS THROUGH A TRANSMISSION CHANNEL WITH LIMITED BANDWIDTH

RELATED APPLICATION

The present application relates to co-pending PCT application PCT/US96/04974, filed April 10, 1996, entitled "System For Compression and Decompression of Audio Signals For Digital Transmission" by the same inventor and assigned to the Assignee of the present application. The co-pending PCT application noted above is incorporated by reference in its entirety along with any appendices and attachments thereto.

FIELD OF THE INVENTION

The present invention relates generally to an apparatus and method for transmitting audio signals and pertains, more specifically, to an apparatus and method for transmitting a high quality audio signal, such as wideband speech, through a transmission channel having a limited bandwidth or transmission rate.

BACKGROUND OF THE INVENTION

Human speech lies in the frequency range of approximately 7 Hz to 10 kHz. Because traditional telephone systems only provide for the transmission of analog audio signals in the range of about 300 Hz to 3400 Hz or a bandwidth of about 3 kHz (narrowband speech), certain characteristics of a speaker's voice are lost and the voice sounds somewhat muffled. A telephone system capable of transmitting an audio signal

approaching the quality of face-to-face speech requires a bandwidth of about 6 kHz (wideband speech).

Known digital transmission systems are capable of transmitting wideband speech audio signals. However, in order to produce an output audio signal of acceptable quality with a bandwidth of 6 kHz, these digital systems require a transmission channel with a transmission rate that exceeds the capacity of traditional telephone lines. A digital system transmits audio signals by coding an input audio signal into a digital signal made up of a sequence of binary numbers or bits, transmitting the digital signal through a transmission channel, and decoding the digital signal to produce an output audio signal. During the coding process the digital signal is reduced or compressed to minimize the necessary transmission rate of the signal. One known method for compressing wideband speech is disclosed in Recommendation G.722 (CCITT, 1988). A system using the compression method described in G.722 still requires a transmission rate of at least 48 kbit/s to produce wideband speech of an acceptable quality.

Because the maximum transmission rate over traditional telephone lines is 28.8 kbit/s using the most advanced modem technology, alternative transmission channels such as satellite or fiber optics would have to be used with an audio transmission system employing the data compression method disclosed in G.722. Use of these alternative transmission channels is both expensive and inconvenient due to their limited availability. While fiber optic lines are available, traditional copper telephone lines now account for an overwhelming majority of existing lines and it is unlikely that this balance will change anytime in the near future. A digital phone system capable of transmitting wideband speech over existing transmission rate limited telephone phone lines is therefore highly desirable.

OBJECTS OF THE INVENTION

The disclosed invention has various embodiments that achieve one or more of the following features or objects:

An object of the present invention is to provide for the transmission of high quality wideband speech over existing telephone networks.

A further object of the present invention is to provide for the transmission of high quality audio signals in the range of 20 Hz to at least 5,500 Hz over existing telephone networks.

A still further object of the present invention is to accomplish data compression on wideband speech signals to produce a transmission rate of 28.8 kbit/s or less without significant loss of audio quality.

A still further object of the present invention is to provide a device which allows a user to transmit and receive high quality wideband speech and audio over existing telephone networks.

A still further object of the present invention is to provide a portable device which is convenient to use and allows ease of connection to existing telephone networks.

A still further object of the present invention is to provide a device which is economical to manufacture.

A still further object of the present invention is to provide easy and flexible programmability.

SUMMARY OF THE INVENTION

In accordance with the present invention, the disadvantages of the prior art have been overcome by providing a digital audio transmitter system capable of transmitting high quality, wideband speech over a transmission channel with a limited bandwidth such as a traditional telephone line.

More particularly, the digital audio transmitter system of the present invention includes a coder for

coding an input audio signal to a digital signal having a transmission rate that does not exceed the maximum allowable transmission rate for traditional telephone lines and a decoder for decoding the digital signal to provide an output audio signal with an audio bandwidth of wideband speech. A coder and a decoder may be provided in a single device to allow two-way communication between multiple devices. A device containing a coder and a decoder is commonly referred to as a CODEC (COder/DECoder).

These and other objects, advantages and novel features of the present invention, as well as details of an illustrative embodiment thereof, will be more fully understood from the following description and from the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a digital audio transmission system including a first CODEC and second CODEC in accordance with the present invention.

Fig. 2 is a block diagram of a CODEC of Fig. 1.

Fig. 3 is a block diagram of an audio input/output circuit of a CODEC.

Fig. 4 is a detailed circuit diagram of the audio input portion of Fig. 3.

Fig. 5 is a detailed circuit diagram of the level LED's portion of Fig. 3.

Fig. 6 is a detailed circuit diagram of the headphone amp portion of Fig. 3.

Fig. 7 is a block diagram of a control processor of a CODEC.

Fig. 8 is a detailed circuit diagram of the microprocessor portion of the control processor of Fig. 7.

Fig. 9 is a detailed circuit diagram of the memory portion of the control processor of Fig. 7.

Fig. 10 is a detailed circuit diagram of the dual UART portion of the control processor of Fig. 7.

Fig. 11 is a detailed circuit diagram of the keypad, LCD display and interface portions of the control processor of Fig. 7.

Fig. 12 is a block diagram of an encoder of a CODEC.

Fig. 13 is a detailed circuit diagram of the encoder digital signal processor and memory portions of the encoder of Fig. 12. Fig. 14 is a detailed circuit diagram of the clock generator portion of the encoder of Fig. 12.

Fig. 15 is a detailed circuit diagram of the Reed-Soloman encoder and decoder portions of Figs. 12 and 16.

Fig. 16 is a block diagram of a decoder of a CODEC.

Fig. 17 is a detailed circuit diagram of the encoder digital signal processor and memory portions of the decoder of Fig. 16.

Fig. 18 is a detailed circuit diagram of the clock generator portion of the decoder of Fig. 16.

Fig. 19 is a detailed circuit diagram of the analog/digital converter portion of the encoder of Fig. 12.

Fig. 20 is a detailed circuit diagram of the digital/analog converter portion of the decoder of Fig. 16.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A digital audio transmission system 10, as shown in Fig. 1, includes a first CODEC (COder/DECoder) 12 for transmitting and receiving a wideband audio signal such as wideband speech to and from a second CODEC 14 via a traditional copper telephone line 16 and telephone network 17. When transmitting an audio signal, the first CODEC 12 performs a coding process on the input analog audio signal which includes converting the input audio signal to a digital signal and compressing the

digital signal to a transmission rate of 28.8 kbit/s or less. The preferred embodiment compresses the digital using a modified version of the ISO/MPEG (International Standards Organization/Motion Picture Expert Groups) compression scheme according to the software routine disclosed in the microfiche software appendix filed herewith. The coded digital signal is sent using standard modem technology via the telephone line 16 and telephone network 17 to the second CODEC 14. The second CODEC 14 performs a decoding process on the coded digital signal by correcting transmission errors, decompressing the digital signal and reconverting it to produce an output analog audio signal.

Fig. 2 shows a CODEC 12 which includes an analog mixer 20 for receiving, amplifying, and mixing an input audio signal through a number of input lines. The input lines may include a MIC line 22 for receiving an analog audio signal from a microphone and a generic LINE 24 input for receiving an analog audio signal from an audio playback device such as a tape deck. The voltage level of an input audio signal on either the MIC line 22 or the generic LINE 24 can be adjusted by a user of the CODEC 12 by adjusting the volume controls 26 and 28. When the analog mixer 20 is receiving an input signal through both the MIC line 22 and the generic LINE 24, the two signals will be mixed or combined to produce a single analog signal. Audio level LED's 30 respond to the voltage level of a mixed audio signal to indicate when the voltage exceeds a desired threshold level. A more detailed description of the analog mixer 20 and audio level LED's 30 appears below with respect to Figs. 3 and 4.

The combined analog signal from the analog mixer 20 is sent to the encoder 32 where the analog signal is first converted to a digital signal. The sampling rate used for the analog to digital conversion is preferably one-half the transmission rate of the signal which will

ultimately be transmitted to the second CODEC 14 (shown in Fig. 1). After analog to digital conversion, the digital signal is then compressed using a modified version of the ISO/MPEG algorithm. The ISO/MPEG compression algorithm is modified to produce a transmission rate of 28.8 kbit/s. This is accomplished by the software routine that is disclosed in the software appendix.

The compressed digital signal from the encoder 32 is then sent to an error protection processor 34 where additional error protection data is added to the digital signal. A Reed-Solomon error protection format is used by the error protection processor 34 to provide both burst and random error protection. The error protection processor 34 is described below in greater detail with respect to Figs. 12 and 15.

The compressed and error protected digital signal is then sent to an analog modem 36 where the digital signal is converted back to an analog signal for transmitting. As shown in Fig. 1, this analog signal is sent via a standard copper telephone line 16 through a telephone network 17 to the second CODEC 14. The analog modem 36 is preferably a V.34 synchronous modem. This type of modem is commercially available.

The analog modem 36 is also adapted to receive an incoming analog signal from the second CODEC 14 (or another CODEC) and reconvert the analog signal to a digital signal. This digital signal is then sent to an error correction processor 38 where error correction according to a Reed-Soloman format is performed.

The corrected digital signal is then sent to a decoder 40 where it is decompressed using the modified version of the ISO/MPEG algorithm as disclosed in the software appendix. After decompression the digital signal is converted to an analog audio signal. A more detailed description of the decoder 40 appears below with respect to Figs. 7, 16, 17 and 18. The analog

audio signal may then be perceived by a user of the CODEC 12 by routing the analog audio signal through a headphone amp 42 wherein the signal is amplified. The volume of the audio signal at the headphone output line 44 is controlled by volume control 46.

The CODEC 12 includes a control processor 48 for controlling the various functions of the CODEC 12 according to software routines stored in memory 50. A more detailed description of the structure of the control processor appears below with respect to Figs. 7, 8, 9, 10, and 11. One software routine executed by the control processor allows the user of the CODEC 12 to initiate calls and enter data such as phone numbers. When a call is initiated the control processor sends a signal including the phone number to be dialed to the analog modem 36. Data entry is accomplished via a keypad 52 and the entered data may be monitored by observation of an LCD 54. The keypad 52 also includes keys for selecting various modes of operation of the CODEC 12. For example, a user may select a test mode wherein the control processor 48 controls the signal path of the output of the encoder to input of decoder to bypass the telephone network allows testing of compression and decompression algorithms and their related hardware Also stored in memory 50 is the compression algorithm executed by the encoder 32 and the decompression algorithm executed by the decoder 40.

Additional LED's 56 are controlled by the control processor 48 and may indicate to the user information such as "bit synchronization" (achieved by the decoder) or "power on". An external battery pack 58 is connected to the CODEC 12 for supplying power.

Fig. 3 shows a lower level block diagram of the analog mixer 20, audio level LED's 30 and analog headphone amp 42 as shown in Fig. 2. Figs. 4, 5 and 6 are the detailed circuit diagrams corresponding to Fig. 3.

Referring to Fig. 3 and 4, line input 210 is an incoming line level input signal while mic input 220 is the microphone level input. These signals are amplified by a line amp 300 and a mic amp 302 respectively and their levels are adjusted by line level control 304 and mic level control 306 respectively. The microphone and line level inputs are fed to the input mixer 308 where they are mixed and the resulting combined audio input signal 310 is developed.

Referring now to Figs. 3 and 5, the audio input signal 310 is sent to the normal and overload signal detectors, 312 and 314 respectively, where their level is compared to a normal threshold 316 which defines a normal volume level and a clip threshold 318 which defines an overload volume level. When the audio input signal 310 is at a normal volume level a NORM LED 320 is lighted. When the audio input signal 310 is at an overload volume level a CLIP LED 322 is lighted.

Referring now to Figs. 3 and 6, the audio input signal 310 is fed into the record monitor level control 324, where its level is adjusted before being mixed with the audio output signal 336 from the digital/analog converter 442 (shown in Fig. 16 and 20). The audio output signal 336 is fed to the local monitor level control 326 before it is fed into the headphone mixer amplifier 334. The resulting output signal from the headphone mixer amplifier 334 goes to a headphone output connector 338 on the exterior of the CODEC 12 where a pair of headphones may be connected.

The audio input signal 310 and audio output signal 336 are fed to record mix control 328 which is operable by the user. The output of this control is fed to a mix level control 330 (also operable by a user) and then to the record output amplifier 332. The resulting output signal of the record output amplifier 332 goes to a record output 340 on the exterior of the CODEC 12.

Fig. 7 shows a lower level block diagram of the control processor 48 (shown in Fig. 2). The encoder 406 (referenced as number 32 in Fig. 2) is further described in Fig. 12 while the decoder 416 (referenced as number 40 in Fig. 2) is refined in Fig. 16. Figs. 8, 9, 10, 11, 13, 14, 15, 17, 18, 19 and 20 are detailed circuit diagrams.

Referring to Figs. 7 and 8 the microprocessor 400 is responsible for the communication between the user, via keypad 412 and LCD display 414, and the CODEC 12. The keypad 412 is used to input commands to the system while the LCD display 414, is used to display the responses of the keypad 412 commands as well as alert messages generated by the CODEC 12.

Referring now to Figs. 7 and 9, the RAM (random access memory) 402 is used to hold a portion of the control processor control software routines. The flash ROM (read only memory) 404 holds the software routine (disclosed in the software appendix) which controls the modified ISO/MPEG compression scheme performed by encoder DSP 406 and the modified ISO/MPEG decompression scheme performed by the decoder DSP 416, as well as the remainder of the control processor control software routines.

Referring now to Figs. 7 and 10, the dual UART (universal asynchronous receiver/transmitter) 408 is used to provide asynchronous input/output for the control processor 48. The rear panel remote control port 409 and the rear panel RS232 port 411 are used to allow control by an external computer. This external control can be used in conjunction with or instead of the keypad 412 and/or LCD display 414.

Referring now to Figs. 7 and 11, the programmable interval timer circuit 410 is used to interface the control processor with the keypad and LCD display.

Referring now to Figs. 7, 8 and 13, the encoder DSP (digital signal processor) 434 receives a digital pulse

code modulated signal 430 from the analog/digital converter 450. The encoder DSP 434 performs the modified ISO/MPEG compression scheme according to the software routine (described in the software appendix) stored in RAM memory 436 to produce a digital output 418.

The A/D clock generation unit 439 is shown in Figs. 12 and 14. The function of this circuitry is to provide all the necessary timing signals for the analog digital converter 450 and the encoder DSP 434.

The Reed-Soloman error correction encoding circuitry 438 is shown in Figs. 12 and 15. The function of this unit is to add parity information to be used by the Reed-Soloman decoder 446 (also shown in Fig. 16) to repair any corrupted bits received by the Reed-Soloman decoder 446. The Reed-Soloman corrector 438 utilizes a shortened Reed-Soloman GF(256) code which might contain, for example, code blocks containing 170 eight-bit data words and 8 eight-bit parity words.

Referring now to Figs. 7, 16 and 17, the decoder DSP 440 receives a digital input signal 422 from the modem 36 (shown in Fig. 2). The decoder DSP 440 performs the modified ISO/MPEG decompression scheme according to the software routine (described in the software appendix) stored in RAM memory 444 to produce a digital output to be sent to the digital/analog converter 442.

The D/A clock generation unit 448 is shown in Figs. 16 and 18. The function of this circuitry is to provide all the necessary timing signals for the digital/analog converter 442 and the decoder DSP 440.

The analog/digital converter 450, shown in Figs. 12 and 19, is used to convert the analog input signal 310 into a PCM digital signal 430.

The digital/analog converter 442, shown in Figs. 16 and 20 is used to convert the PCM digital signal from

the decoder DSP 440 into an analog audio output signal 336.

The Reed-Soloman error correction decoding circuitry 446, shown in Figs. 15 and 16, decodes a Reed-Soloman coded signal to correct errors produced during transmission of the signal through the modem 36 (shown in Fig. 2) and telephone network.

Another function contemplated by this invention is to allow real time, user operated adjustment of a number of psycho-acoustic parameters of the ISO/MPEG compression/decompression scheme used by the CODEC 12. A manner of implementing this function is described in applicant's application entitled "System For Adjusting Psycho-Acoustic Parameters In A Digital Audio Codec" which is being filed concurrently herewith (such application and related Software Appendix are hereby incorporated by reference). Also, applicants application entitled "System For Compression And Decompression Of Audio Signals For Digital Transmission" and related Software Appendix which are being filed concurrently herewith are hereby incorporated by reference.

This invention has been described above with reference to a preferred embodiment. Modifications and variations may become apparent to one skilled in the art upon reading and understanding this specification. It is intended to include all such modifications and alterations within the scope of the appended claims.

```
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;
        nolist

; \DGCST\def.asm

; This file contains the definitions for various structures.

; The following is the minimum value for slb.  The true value is -1 but
; that causes some computational difficulities so -120 db is used.  The
; minimum value (2**-23) is about -138 db so there is some room left below
; -120 db

;       define MINDB            '-.6228589'     ;-120 dB in slb's
        define MINDB            '-.73'          ;-120 dB in slb's

; Define the IO for the watch dog timer for bit set and bit clears

        define  WATCH_DOG       '#7,x:<<$FFE4'  ; M_PBD bit 7 watch dog timer

; The following defines the sampling rates

        define  SAM32K          '0'     ;sampling rate of 32 kHz
        define  SAM48K          '1'     ;sampling rate of 48 kHz
;!!!28.8
        define  SAM16K          '2'     ;sampling rate of 14.4 kHz
        define  SAM24K          '3'     ;sampling rate of 14.4 kHz
;       define  SAM16K          '2'     ;sampling rate of 16 kHz
;       define  SAM24K          '3'     ;sampling rate of 24 kHz
;!!!28.8
        define  SAM441K         '4'     ;sampling rate of 44.1 kHz

;!!!28.8
        define  SAMTYPE         '2'     ;set the sampling rate to 14.4 kHz
;!!!28.8

; The following defines various parameters

        define  NUMPFFT         '1024'  ;number of points used by the fft

; The following define the types of maskers.
; ENDMSKR is not counted in the nmaskers count.

        define  DELETEDMSKR     '0'     ;the masker type of deleted
        define  NONTONAL        '1'     ;the masker type of non-tonal
        define  TONAL           '2'     ;the masker type of tonal
        define  ENDMSKR         '3'     ;the last masker in the array

; The following define a tonal structure.
; This structure occupies both x an y memory (1).

        define  TONALSSIZE      '2'     ;length of the structure
        define  TONALSPWRDB     '0'     ;offset to the tonal power (1)
        define  TONALSBIN       '1'     ;offset to the bin (x)
        define  MAXTONALS       '50'    ;the maximum number of tonals

; The following define the sync info for the receiver.  The sync pattern may
; be in general any NSYNC bits. The SYNCMSK must contain NSYNC 1's right
; justified and is used to isolate the sync word.  MUSICAM uses 12 1's as
```

```
; the sync word.
        define  SYNC             '$000fff'     ;sync pattern left justifed
        define  SYNCMSK          '$000fff'     ;mask high order from getvalue
        define  NSYNC            '12'          ;len sync word (hdr bits 0-11)

; For framing purposes by the decoder and unpadded frames, 24 bits are used:
;       the 1st 12 bits must be 1's
;       the next 4 bits are the 1st 4 bits of frame header of
;               the constant 'C' (1100);
;       skip over the next 4 bits of the frame header that are reserved
;               for the bit rate
;       the next 2 bits (01) of the frame header that represent sampling rate:
;               '01' = 48 K sampling rate
;               '10' = 32 K sampling rate
;
;!!!28.8
;               '00' = 24 K sampling rate (14.4 K rate)
;               '00' = 16 K sampling rate (14.4 K rate)
;               '11' = 24 K sampling rate
;;              '00' = 16 K sampling rate
;;
;!!!28.8
;       the next 2 constant 0 bits of the frame header.
; The SYNCMSK must conform to the right justified framing sync pattern is used
; to isolate the sync word.

        define  FRAMESYNC_48K    '$fffc04'     ;sync pattern for 48 K sampling
        define  FRAMESYNC_32K    '$fffc08'     ;sync pattern for 32 K sampling
;!!!28.8
        define  FRAMESYNC_24K    '$fffc0c'     ;sync pattern for 24 K sampling
;       define  FRAMESYNC_24K    '$fffc00'     ;sync pattern - 14.4 K sampling
        define  FRAMESYNC_16K    '$fffc00'     ;sync pattern - 14.4 K sampling
        define  FRAMESYNC_16K    '$fffc00'     ;sync pattern for 16 K sampling
;
;!!!28.8
        define  FRAMENSYNC       '24'          ;len sync word (hdr bits 0-23)
        define  FRAMESYNCMSK     '$ffff0f'     ;mask reflect framing sync ptn
        define  GETSYNCMSK       '$000fff'     ;mask high order from getvalue

; The following define the number of bits used by the fixed part of the
; MUSICAM frame.

        define  NSYST            '20'          ;length of the system info header

; define the use of protection check sum or not

        define  CRC_NO_PROTECT   '0'           ; protection does not apply
        define  CRC_PROTECT      '1'           ; protection applies

        define  NCRCBITS         '16'          ; 16 bit check sum
        define  MASKCRC          '$00ffff'     ;mask high order from getvalue

        define  CRC_SUM_BIT_OFFSET '16'        ; 16th bit offset start at bit rate
                                               ;   to calculate checksum
        define  CRC_VALUE        '$800500'     ; checksum divisor
        define  CRC_STORED_BIT_OFFSET '16'     ; bit offset to store checksum
                                               ;   following the 32 bit header

; define the number of bits to be included in the checksum
;       for the header and the checksum itself
;       for one channel in mono
```

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        define  CRC_BITS_A          '32'        ; incl bits from hdr & checksum
        define  CRC_BITS_B          '142'       ; incl bits per used channel:
                                                ;    BALs = 88, SBits = 54

; code for the new ISO frame header (these are coded as left justified)

        define  SYSTHDR_1_NO_PROT           '$00000d'   ; bits 12-15:  1101 (4 bits)
        define  SYSTHDR_1_NO_PROT_LOW       '$000005'   ; bits 12-15:  0101 (4 bits)
        define  SYSTHDR_1_PROTECT           '$00000c'   ; bits 12-15:  1100 (4 bits)
        define  SYSTHDR_1_PROTECT_LOW       '$000004'   ; bits 12-15:  0100 (4 bits)

        define  SYSTHDR_2           '$000000'   ; hdr bits 22-23:  00   (2 bits)

;use Copyright bit to indicate to decoder if CCS compression applies:
;  bit 28: 0 means NO CCS compression
;          1 means audio coded with CCS compression

        define  SYSTHDR_3_NO_CCS_COMPRESS           '$000000'   ; bits 28-31:0000 (4)
        define  SYSTHDR_3_CCS_COMPRESS              '$000008'   ; bits 28-31:1000 (4)

        define  NSYSTHDR_1          '4'         ; 4 bits for header field 1
        define  NSYSTHDR_2          '2'         ; 2 bits for header field 2
        define  NSYSTHDR_3          '4'         ; 4 bits for header field 3
        define  MASKSYSTHDR_1       '$00000f'   ;mask high order from getvalue
        define  MASKSYSTHDR_2       '$000003'   ;mask high order from getvalue
        define  MASKSYSTHDR_3       '$00000f'   ;mask high order from getvalue

; codes for the type of framing (2 bits in bits 24-25 of frame header)

        define  FULL_STEREO         '$000000'   ; 00 stereo-left & right channels
        define  JOINT_STEREO        '$000001'   ; 01 stereo intensity-2 channels
        define  DUAL                '$000002'   ; 10 dual-2 channels
        define  MONO                '$000003'   ; 11 mono-1 channel only

        define  NFRAMETYPE          '2'         ; 2 bits for type of frame field
        define  MASKFRAMETYPE       '$000003'   ;mask high order from getvalue

; bit flags for controlling the type of framing during bit allocation & coding

        define  STEREO_vs_MONO          '0'     ;0 = 2 channels, 1 = one
        define  LEFT_vs_RIGHT           '1'     ;0 = left channel, 1 = right
        define  JOINT_FRAMING           '2'     ;0 = not JOINT STEREO, 1 = yes
        define  JOINT_at_FULL           '3'     ;FULL Stereo upgrade allocation
                                                ; 1 = YES at full, 0 = joint
        define  JOINT_at_SB_BOUND       '4'     ;has stereo intensity sub-band
                                                ; boundary been reached:
                                                ;    0 = NO, 1 = YES
        define  FIRST_TIME              '5'     ;did loop thru allocation tests
                                                ; make any new bit allocation
                                                ;    0 = yes, 1 = no
        define  MASKING_PASS            '6'     ;allocate to masking threshold:
                                                ; 0=YES, 1=no (ALL are below)
        define  HEARING_PASS            '7'     ;alloc to threshold of hearing:
                                                ; 0=YES, 1=no (ALL are below)
        define  FINAL_PASS              '8'     ;allocate pass of what's left:
                                                ; 0 = NO, 1 = YES
        define  AT_LIMIT_SUBBAND        '9'     ;does NOT req at least 1 alloc
        define  AT_USED_SUBBAND         '10'    ;above used sub-band limit
        define  SUMMARY_ALARM           '16'    ;did any alarm get sensed
                                                ; 0 = NO, 1 = YES
```

```
        define  PROTECT                    '18'    ;should checksum (CRC16) protect
                                                   ; 0 = NO, 1 = YES
        define  MONO_OUT_CHANNEL           '19'    ;output to only one channel:
                                                   ; 0 = left, 1 = right
        define  MONO_OUT_BOTH              '20'    ;output mono to both channels:
                                                   ; 0 = NO only one, 1 = YES
        define  LEFT_SINE_WAVE             '21'    ;left channel music vs tone
                                                   ; 0 = NO only one, 1 = YES
        define  RIGHT_SINE_WAVE            '22'    ;right channel music vs tone
                                                   ; 0 = NO only one, 1 = YES
        define  LOW_vs_HIGH_SAMPLING       '23'    ;encode low or high sample rate:
                                                   ; 0 = low, 1 = high

;decoding overload flag

        define  SKF_ZERO        '3'        ;sensed a zero scale factor
                                           ; 0 = no, 1 = yes

;define bit position flags for decoding frames with the CRC-16 checksum

        define  USE_SAVED       '6'        ;checksum failed use saved frame
        define  FRAME_SAVED     '7'        ;a good frame was saved for use
        define  SAVE_FRAME      '8'        ;save this good frame for use
        define  USING_SAVED     '9'        ;this frame is the saved frame
        define  REFRAME         '10'       ;cnt bit errors exceeded, reframe

;define decoder auto selection flags for:
;       bit rate (determined by trying to frame at each of the two
;                       bit rate choices)
;       type of audio data (MUSICAM frames or G722)
;               (determined by not being able to frame at either
;                       of the two bit rate choices)
;       sampling rate (determined from a MUSICAM frame header)
; (if NOT auto selected, some other switch sets the value)

        define AUTO_SELECT_BIT_RATE        '11'    ;0=NO, 1=YES
        define AUTO_SELECT_DATA_TYPE       '12'    ;0=NO, 1=YES
        define AUTO_SELECT_SAMPLE_RATE     '13'    ;0=NO, 1=YES
        define MUSICAM_vs_G722             '14'    ;0=MUSICAM, 1=G722
        define SAMPLE_RATE_LOW_vs_HIGH     '15'    ;0=low, 1=high

; this flag indicates if CCS compression applies to getdata.asm

        define  DECOMPRESS_PACKED          '16'

;this flag indicates that the framing process has previously determined
; that the input data to the MICRO decoder is a stream of MUSICAM frames

        define MUSICAM_INPUT_SET           '17'    ;0=NO, 1=YES

;define flag that the current frame has a sync word violation

        define  NO_SYNC                    '21'

;define flag that determines which ISO CRC-16 controls to use:
;       0 = OLD controls: seed with 0's and fixed span of bits covered
;       1 = NEW controls: seed with F's and dynamic span over the SBits

        define  CRC_OLD_vs_NEW             '22'
```

```
;define the sub-band allocation AtLimit bit flags that control selection

        define  MASKING_LIMIT    '0'     ;1 reached sub-band's masking threshold
        define  HEARING_LIMIT    '1'     ;1 reached sub-band's hearing threshold
        define  ALLOCATE_LIMIT   '2'     ;1 reached sub-band;s max bit limit
        define  NO_ALLOCATE      '3'     ;1 NO allocation at this sub-band

;define the standard limit of sub-bands requiring at least 1 level of
; allocation even if the signal is below the Global Masking Threshold

        define  LIMITSUBBANDS    '17'    ;sub-bands 0 thru 16 get at least 1

;define the number of successive frames that a sub-band did not need any bits
; allocated before shuttting the sub-band from being allocated

        define  FRAMELIMIT       '4'

; codes for stereo intensity subband bound (2 bits 25-27 of frame header)

        define  INTENSITY_4      '$000000'  ; 00 subbands 4-31 intensity mode
        define  INTENSITY_8      '$000001'  ; 01 subbands 8-31 intensity mode
        define  INTENSITY_12     '$000002'  ; 10 subbands 12-31 intensity mode
        define  INTENSITY_16     '$000003'  ; 11 subbands 16-31 intensity mode

        define  NSTINTENSITY     '2'        ; 2 bits for intensity boundary
        define  MASKSTINTENSITY  '$000003'  ;mask high order from getvalue

; stereo intensity boundary sub-band counts

        define  BOUND_4          '4'        ; 0-3 full stereo, 4-31 intensity
        define  BOUND_8          '8'        ; 0-7 full stereo, 8-31 intensity
        define  BOUND_12         '12'       ; 0-11 full stereo, 12-31 intensity
        define  BOUND_16         '16'       ; 0-15 full stereo, 16-31 intensity

; codes for output bit rates (4 bits in positions 16-19 of frame header)

        define  BITRATE_FREE     '$000000'  ; 0000 @ unknown kbits/s
        define  BITRATE_32       '$000001'  ; 0001 @ 32 kbits/s
        define  BITRATE_48       '$000002'  ; 0010 @ 48 kbits/s
;!!!28.8
        define  BITRATE_56       '$000003'  ; 0011 @ 28.8 kbits/s
        define  BITRATE_64       '$000003'  ; 0011 @ 28.8 kbits/s
;       define  BITRATE_56       '$000003'  ; 0011 @ 56 kbits/s
;       define  BITRATE_64       '$000004'  ; 0100 @ 64 kbits/s
;!!!28.8
        define  BITRATE_80       '$000005'  ; 0101 @ 80 kbits/s
        define  BITRATE_96       '$000006'  ; 0110 @ 96 kbits/s
        define  BITRATE_112      '$000007'  ; 0111 @ 112 kbits/s
        define  BITRATE_128      '$000008'  ; 1000 @ 128 kbits/s
        define  BITRATE_160      '$000009'  ; 1001 @ 160 kbits/s
        define  BITRATE_192      '$00000a'  ; 1010 @ 192 kbits/s
        define  BITRATE_224      '$00000b'  ; 1011 @ 224 kbits/s
        define  BITRATE_256      '$00000c'  ; 1100 @ 256 kbits/s
        define  BITRATE_320      '$00000d'  ; 1101 @ 320 kbits/s
        define  BITRATE_384      '$00000e'  ; 1110 @ 384 kbits/s

;low sample rates: 24000, 22050 and 16000
; codes for output bit rates (4 bits in positions 16-19 of frame header)

        define  BITRATE_FREE_LOW '$000000'  ; 0000 @ unknown kbits/s
```

```
        define  BITRATE_8_LOW      '$000001'   ; 0001 @ 8 kbits/s
        define  BITRATE_16_LOW     '$000002'   ; 0010 @ 16 kbits/s
        define  BITRATE_24_LOW     '$000003'   ; 0011 @ 24 kbits/s
        define  BITRATE_32_LOW     '$000004'   ; 0100 @ 32 kbits/s
        define  BITRATE_40_LOW     '$000005'   ; 0101 @ 40 kbits/s
        define  BITRATE_48_LOW     '$000006'   ; 0110 @ 48 kbits/s
        define  BITRATE_56_LOW     '$000007'   ; 0111 @ 56 kbits/s
        define  BITRATE_64_LOW     '$000008'   ; 1000 @ 64 kbits/s
        define  BITRATE_80_LOW     '$000009'   ; 1001 @ 80 kbits/s
        define  BITRATE_96_LOW     '$00000a'   ; 1010 @ 96 kbits/s
        define  BITRATE_112_LOW    '$00000b'   ; 1011 @ 112 kbits/s
        define  BITRATE_128_LOW    '$00000c'   ; 1100 @ 128 kbits/s
        define  BITRATE_144_LOW    '$00000d'   ; 1101 @ 144 kbits/s
        define  BITRATE_160_LOW    '$00000e'   ; 1110 @ 160 kbits/s

        define  NBITRATE           '4'         ; 4 bits for bit rate code in hdr
        define  MASKNBITRATE       '$00000f'   ;mask high order from getvalue

; codes for input sampling rate (2 bits in positions 20-21 of frame header)

;!!!28.8
        define  SAMPLE_ID_BIT_HIGH      '1'
        define  SAMPLINGRATE_16 '$000000'   ; 00 @ 14.4 kHz
        define  SAMPLINGRATE_24 '$000000'   ; 00 @ 14.4 kHz
        define  SAMPLINGRATE_16 '$000000'   ; 00 @ 16 kHz
;
        define  SAMPLINGRATE_48 '$000001'   ; 01 @ 48 kHz
        define  SAMPLINGRATE_32 '$000002'   ; 10 @ 32 kHz
        define  SAMPLINGRATE_24 '$000003'   ; 11 @ 24 kHz
;
;!!!28.8

        define  NSAMPLERATE          '2'         ; 2 bits for sampling rate in hdr
        define  MASKNSAMPLERATE      '$000003'   ;mask high order from getvalue

        define  NSBITS               '2'         ;length of the scale factor select
        define  MASKNSBITS           '$000003'   ;mask high order from getvalue

; The following defines the masker structure.
; This structure occupies both x an y memory (1).

        define  MASKERSSIZE          '3'     ;length of the structure
        define  MASKERSPWRDB         '0'     ;offset to masker power (1 for watts
                                             ; and x for dB)
        define  MASKERSRDPWRDB       '0'     ;offset to reduced power in db (y)
        define  MASKERSBIN           '1'     ;offset to bin number (x)
        define  MASKERSBFREQ         '1'     ;offset to freq in bark (y)
        define  MASKERSTYPE          '2'     ;offset to masker type  (x)
        define  MASKERSCRITBND       '2'     ;offset to msker crital band if noise(y)

;highest number of critical bands for all sampling rates

        define  NUMMAXCRITBNDS   '26'

        if SAMTYPE==SAM16K
;!!!28.8
        define  MAXCRITBNDS          '21'    ;number of critical bands
;!!!28.8
        endif

        if SAMTYPE==SAM24K
;!!!28.8
```

```
        define  MAXCRITBNDS        '21'     ;number of critical bands
;       define  MAXCRITBNDS        '23'     ;number of critical bands
;!!!28.8
        endif

        if SAMTYPE==SAM32K
        define  MAXCRITBNDS        '24'     ;number of critical bands
        endif

        if SAMTYPE==SAM48K
        define  MAXCRITBNDS        '24'     ;number of critical bands
        endif

;!!!28.8
        define  MAXCRITBNDS_16     '21'     ;number of critical bands at 14.4 K
        define  MAXCRITBNDS_24     '21'     ;number of critical bands at 14.4 K
;       define  MAXCRITBNDS_16     '21'     ;number of critical bands at 16 K
;       define  MAXCRITBNDS_24     '23'     ;number of critical bands at 24 K
;!!!28.8
        define  MAXCRITBNDS_32     '24'     ;number of critical bands at 32 K
        define  MAXCRITBNDS_48     '24'     ;number of critical bands at 48 K

; The following defines the Aliasing structure
; This structure only occupies x or y memory

        define  ALIASSIZE          '2'      ;length of the structure
        define  ALIASBIN           '0'      ;bin number of aliaser (0-511)
        define  ALIASPWRDB         '1'      ;power of the aliaser in slb

;
; General things

        define NUMSUBBANDS         '32'     ;number of sub-bands
        define NUMBLOCKS           '3'      ;number of blocks per super-frame
        define NUMPERBLK           '384'    ;number of points per block
        define NUMPERSUBBAND       '12'     ;number of points per sub-band
        define SKF                 '6'      ;number of bits per scale factor
        define MASKSKF             '$00003f'  ;mask high order from getvalue
        define SKFX2               '64'     ;number of scale factors
        define BINSPERSUBBAND      '16'     ;number of FFT bins per subband
        define NUMCHANNELS         '2'      ;two channels: left and right
        define NUMSNRPOSITIONS     '18'     ;18 Signal-to-Noise position codes
        define NUMINDEXES          '16'     ;16 position codes Allowed per sub-band

        define MAXSUBBANDS_CCS     '30'     ;maximum sub-bands to ever be used
        define MINSUBBANDS_CCS     '4'      ;minimum sub-bands to ever be used
        define MAXSUBBANDS_LO      '14'     ;low bit rate max sub-bands ever used

;define the used subbands for 64 and 56 KBits
;  (sampling rate / 2) = max Hz / by 32 sub-bands = Hz per sub-band
;       based on sampling rate:
;               14400 @ 225 Hz per sub-band (14400/(2*32:NUMSUBBANDS) = 225)
;               16000 @ 250 Hz per sub-band (16000/(2*32:NUMSUBBANDS) = 250)
;               24000 @ 375 Hz per sub-band (24000/(2*32:NUMSUBBANDS) = 375)
;               32000 @ 500 Hz per sub-band (32000/(2*32:NUMSUBBANDS) = 500)
;               48000 @ 750 Hz per sub-band (48000/(2*32:NUMSUBBANDS) = 750)
;       also based on bandwidth code selection from a pair external switches:
;               00 = CCS standard
;               01 = 1 sub-band less than standard
;               10 = 2 sub-bands less than standard
```

```
;               11 = 3 sub-bands less than standard
;       define USEDSUBBANDS_00_16 '27'   ;  6750 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_01_16 '26'   ;  6500 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_10_16 '25'   ;  6250 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_11_16 '24'   ;  6000 Hz @ 16000 Hz sampling
;!!!28.8
        define USEDSUBBANDS_00_16 '30'   ;  6750 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_01_16 '26'   ;  5850 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_10_16 '22'   ;  4950 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_11_16 '18'   ;  4050 Hz @ 14400 Hz sampling
;       define USEDSUBBANDS_00_16 '22'   ;  5500 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_01_16 '21'   ;  5250 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_10_16 '20'   ;  5000 Hz @ 16000 Hz sampling
;       define USEDSUBBANDS_11_16 '18'   ;  4500 Hz @ 16000 Hz sampling
;!!!28.8

;!!!28.8
        define USEDSUBBANDS_00_24 '30'   ;  6750 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_01_24 '26'   ;  5850 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_10_24 '22'   ;  4950 Hz @ 14400 Hz sampling
        define USEDSUBBANDS_11_24 '18'   ;  4050 Hz @ 14400 Hz sampling
;       define USEDSUBBANDS_00_24 '27'   ; 10125 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_01_24 '26'   ;  9750 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_10_24 '25'   ;  9375 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_11_24 '24'   ;  9000 Hz @ 24000 Hz sampling
;!!!28.8
;       define USEDSUBBANDS_00_24 '18'   ;  6750 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_01_24 '16'   ;  6000 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_10_24 '14'   ;  5250 Hz @ 24000 Hz sampling
;       define USEDSUBBANDS_11_24 '12'   ;  4500 Hz @ 24000 Hz sampling

        define USEDSUBBANDS_00_32 '20'   ; 10000 Hz @ 32000 Hz sampling
        define USEDSUBBANDS_01_32 '19'   ;  9500 Hz @ 32000 Hz sampling
        define USEDSUBBANDS_10_32 '18'   ;  9000 Hz @ 32000 Hz sampling
        define USEDSUBBANDS_11_32 '17'   ;  8500 Hz @ 32000 Hz sampling

        define USEDSUBBANDS_00_48 '11'   ;  8250 Hz @ 48000 Hz sampling
        define USEDSUBBANDS_01_48 '10'   ;  7500 Hz @ 48000 Hz sampling
        define USEDSUBBANDS_10_48 '9'    ;  6750 Hz @ 48000 Hz sampling
        define USEDSUBBANDS_11_48 '8'    ;  6000 Hz @ 48000 Hz sampling

        define INPCM            '1152'   ;NUMPERBLK*NUMBLOCKS
        define PCMSIZE          '2560'   ;NUMPERBLK*NUMBLOCKS*2+256
;       define PCMSIZE          '1152'   ;NUMPERBLK*NUMBLOCKS !!!dbg!!!
;       define PCMSIZE          '2304'   ;NUMPERBLK*NUMBLOCKS*2 !!!dbg!!!

        if SAMTYPE==SAM16K
;!!!28.8
        define RATE56           '0'      ;dip switch code for 28.8 Kbits
        define OUTM56           '96'     ;96 output words (2304 bits)
        define OUTB56           '2304'   ;.080 * 28800

        define RATE64           '0'      ;dip switch code for 28.8 Kbits
        define OUTM64           '96'     ;96 output words (2304 bits)
        define OUTB64           '2304'   ;.080 * 28800

;       define RATE56           '0'      ;dip switch code for 56 Kbits
;       define OUTM56           '168'    ;168k output words (4032 bits)
;       define OUTB56           '4032'   ;.072 * 56000
```


BAD ORIGINAL

```
;       define RATE64           '1'     ;dip switch code for 64 Kbits
;       define OUTM64           '192'   ;192k output words (4608 bits)
;       define OUTB64           '4608'  ;.072 * 64000
;!!!28.8
        endif

        if SAMTYPE==SAM24K
;!!!28.8
        define RATE56           '0'     ;dip switch code for 28.8 Kbits
        define OUTM56           '96'    ;96 output words (2304 bits)
        define OUTB56           '2304'  ;.080 * 28800

        define RATE64           '0'     ;dip switch code for 28.8 Kbits
        define OUTM64           '96'    ;96 output words (2304 bits)
        define OUTB64           '2304'  ;.080 * 28800

;       define RATE56           '0'     ;dip switch code for 56 Kbits
;       define OUTM56           '112'   ;112k output words (2688 bits)
;       define OUTB56           '2688'  ;.048 * 56000

;       define RATE64           '1'     ;dip switch code for 64 Kbits
;       define OUTM64           '128'   ;128k output words (3072 bits)
;       define OUTB64           '3072'  ;.048 * 64000
;!!!28.8
        endif

        if SAMTYPE==SAM32K
        define RATE56           '0'     ;dip switch code for 56 Kbits
        define OUTM56           '84'    ;84k output words (2016 bits)
        define OUTB56           '2016'  ;.036 * 56000

        define RATE64           '1'     ;dip switch code for 64 Kbits
        define OUTM64           '96'    ;96k output words (2304 bits)
        define OUTB64           '2304'  ;.036 * 64000
        endif

        if SAMTYPE==SAM48K
        define RATE56           '0'     ;dip switch code for 56 Kbits
        define OUTM56           '56'    ;56k output words (1344 bits)
        define OUTB56           '1344'  ;.024 * 64000

        define RATE64           '1'     ;dip switch code for 64 Kbits
        define OUTM64           '64'    ;64k output words (1536 bits)
        define OUTB64           '1536'  ;.024 * 64000
        endif

        define RATE_LO          '0'     ;dip switch code for lower Kbit rate
        define RATE_HI          '1'     ;dip switch code for higher Kbit rate

; define framing bit rate values for sampling at 16 K

        define OUTM32_16        '96'    ;96k output words (2304 bits)
        define OUTB32_16        '2304'  ;.072 * 32000
        define OUTM48_16        '144'   ;144k output words (3456 bits)
        define OUTB48_16        '3456'  ;.072 * 48000
;!!!28.8
        define OUTM56_16        '96'    ;96 output words (2304 bits)
        define OUTB56_16        '2304'  ;.080 * 28800
        define OUTM64_16        '96'    ;96 output words (2304 bits)
```

```
        define OUTB64_16          '2304'    ;.080 * 28800
        define OUTM56_16          '168'     ;168k output words (4032 bits)
;       define OUTB56_16          '4032'    ;.072 * 56000
;       define OUTM64_16          '192'     ;192k output words (4608 bits)
;       define OUTB64_16          '4608'    ;.072 * 64000
;!!!28.8

; define framing bit rate values for sampling at 24 K

        define OUTM32_24          '64'      ;64k output words (1536 bits)
        define OUTB32_24          '1536'    ;.048 * 32000
        define OUTM48_24          '96'      ;96k output words (2304 bits)
        define OUTB48_24          '2304'    ;.048 * 48000
;!!!28.8
        define OUTM56_24          '96'      ;96 output words (2304 bits)
        define OUTB56_24          '2304'    ;.080 * 28800
        define OUTM64_24          '96'      ;96 output words (2304 bits)
        define OUTB64_24          '2304'    ;.080 * 28800
;       define OUTM56_24          '112'     ;112k output words (2688 bits)
;       define OUTB56_24          '2688'    ;.048 * 56000
;       define OUTM64_24          '128'     ;128k output words (3072 bits)
;       define OUTB64_24          '3072'    ;.048 * 64000
;!!!28.8

; define framing bit rate values for sampling at 32 K

        define OUTM32_32          '48'      ;48k output words (1152 bits)
        define OUTB32_32          '1152'    ;.036 * 32000
        define OUTM48_32          '72'      ;72k output words (1728 bits)
        define OUTB48_32          '1728'    ;.036 * 48000
        define OUTM56_32          '84'      ;84k output words (2016 bits)
        define OUTB56_32          '2016'    ;.036 * 56000
        define OUTM64_32          '96'      ;96k output words (2304 bits)
        define OUTB64_32          '2304'    ;.036 * 64000

; define framing bit rate values for sampling at 48 K

        define OUTM32_48          '32'      ;32k output words (768 bits)
        define OUTB32_48          '768'     ;.024 * 32000
        define OUTM48_48          '48'      ;48k output words (1152 bits)
        define OUTB48_48          '1152'    ;.024 * 48000
        define OUTM56_48          '56'      ;56k output words (1344 bits)
        define OUTB56_48          '1344'    ;.024 * 64000
        define OUTM64_48          '64'      ;64k output words (1536 bits)
        define OUTB64_48          '1536'    ;.024 * 64000

;highest number of freqs used for coding for all sampling rates

        define MAXNMSKFREQS       '132'

;number of freqs used for coding based on defined sampling rates

        if SAMTYPE==SAM16K
;!!!28.8
        define NMSKFREQS          '132'     ;number of freqs used for coding
;!!!28.8
        endif

        if SAMTYPE==SAM24K
;!!!28.8
```

```
        define NMSKFREQS        '132'   ;number of freqs used for coding
;!!!28.8
        endif

        if SAMTYPE==SAM32K
        define NMSKFREQS        '132'   ;number of freqs used for coding
        endif

        if SAMTYPE==SAM48K
        define NMSKFREQS        '126'   ;number of freqs used for coding
        endif

;!!!28.8
        define NMSKFREQS_16     '132'   ;num freqs used for coding at 14.4 K
        define NMSKFREQS_24     '132'   ;num freqs used for coding at 14.4 K
;       define NMSKFREQS_16     '132'   ;num freqs used for coding at 16 K
;       define NMSKFREQS_24     '132'   ;num freqs used for coding at 24 K
;!!!28.8
        define NMSKFREQS_32     '132'   ;num freqs used for coding at 32 K
        define NMSKFREQS_48     '126'   ;num freqs used for coding at 48 K

; the following indicates if CCS compression for positions: 1, 2 and 3

;       define  COMPRESS        '0'     ;0 indicates no CCS compression
        define  COMPRESS        '1'     ;1 indicates use CCS compression

; define uncompressed getdata() getvalue masks for unpack:
;       upack3, upack5 and upack9

        define  MASKUPACK3      '$00001f'  ; 5 bit getvalue retrieved
        define  MASKUPACK5      '$00007f'  ; 7 bit getvalue retrieved
        define  MASKUPACK9      '$0003ff'  ; 10 bit getvalue retrieved

; define CCS compress: getdata() getvalue masks for unpack:
;       upack3, upack5, upack8 and upack9

        define  MASKUPACK3X     '$00000f'  ; 4 bit getvalue retrieved
        define  MASKUPACK5X     '$00003f'  ; 6 bit getvalue retrieved
        define  MASKUPACK8X     '$0000ff'  ; 8 bit getvalue retrieved
        define  MASKUPACK9X     '$0003ff'  ; 10 bit getvalue retrieved

; needed by the decoder rdecode program

        define  NOOF            '5'     ;number of out of frames
        define  NSBUFS          '4'     ;number of sync buffers
        define  MAX_TRIES       '10'    ;restart after framing tries

; needed by the decoder rsynth program

;       define  OUTBUF          '512'   ;size of the output buffer
;       define  OUTBUF          '768'   ;size of the output buffer
;       define  OUTBUF          '1024'  ;size of the output buffer
        define  OUTBUF          '1152'  ;size of the output buffer

; needed by all

        define NPERGROUP        '3'     ;number of samples per processing grp

; This constant is used by xpsycho only to set to offset used to account
; for the phase locked loop (PLL) jitter.
```

```
        define PLLOFSET          '32'        ;number of samples of offset

; define the methods of operation controlled by external switches
;       normal operation vs various dignostic operations

        define  NORMAL_OPER      '$000000'   ; 000 normal opearion
        define  LEFT_1000hz      '$000001'   ; 001 1000 Hz tone left, mute right
        define  RIGHT_1000hz     '$000002'   ; 010 1000 Hz tone right, mute left
        define  BOTH_1000hz      '$000003'   ; 011 1000 Hz tone to both channels
        define  MEMORY_TEST      '$000004'   ; 100 perform memory tests
        define  LEFT_10000hz     '$000005'   ; 101 10000 Hz tone left, mute right
        define  RIGHT_10000hz    '$000006'   ; 110 10000 Hz tone right, mute left
        define  BOTH_10000hz     '$000007'   ; 111 10000 Hz tone to both channels

;define ancillary data baud rates and byte counts per frame time period (msecs)

        define BAUD300           '0'         ;dip switch code for 300 baud
;       define BYTES300          '1'         ;1 byte (7.2 bits ==> 8 bits)
;       define M_SCCR300         '$57d'      ;set clock for 300 baud rate

        define BAUD1200          '1'         ;dip switch code for 1200 baud
;       define BYTES1200         '4'         ;4 bytes (28.8 bits ==> 32 bits)
;       define M_SCCR1200        '$15f'      ;set clock for 1200 baud rate

        define BAUD2400          '2'         ;dip switch code for 2400 baud
;       define BYTES2400         '8'         ;8 bytes (57.6 bits ==> 64 bits)
;       define M_SCCR2400        '$af'       ;set clock for 2400 baud rate

        define BAUD3600          '3'         ;dip switch code for 3600 baud
;       define BYTES3600         '11'        ;11 bytes (86.4 bits ==> 88 bits)
;       define M_SCCR3600        '$74'       ;set clock for 3600 baud rate

        define BAUD4800          '4'         ;dip switch code for 4800 baud
;       define BYTES4800         '15'        ;15 bytes (115.2 bits ==> 120 bits)
;       define M_SCCR4800        '$57'       ;set clock for 4800 baud rate

        define BAUD7200          '5'         ;dip switch code for 7200 baud
;;      define BYTES7200         '22'        ;22 bytes (172.8 bits ==> 176 bits)
;;      define M_SCCR7200        '$3a'       ;set clock for 7200 baud rate

        define BAUD9600          '6'         ;dip switch code for 9600 baud
;       define BYTES9600         '29'        ;29 bytes (230.4 bits ==> 232 bits)
;       define M_SCCR9600        '$2b'       ;set clock for 9600 baud rate

        define BAUD19200         '7'         ;dip switch code for 19200 baud
;       define BYTES19200        '58'        ;58 bytes (460.8 bits ==> 464 bits)
;       define M_SCCR19200       '$15'       ;set clock for 19200 baud rate

        define BAUD7200          '5'         ;dip switch code for 38400 baud
;       define BYTES7200         '116'       ;116 bytes (921.6 bits ==> 928 bits)
;       define M_SCCR7200        '$a'        ;set clock for 38400 baud rate

        define BAUD_KMART_DCD    '8'         ;code forced by box_ctl
;       define BYTE_KMART_42187  '127'       ;127 bytes (1012.5 bits ==> 1016 bits
;       define M_KMART_42187     '$9'        ;set clock for 42187.5 baud rate

        define M_SCR_CD          '$09'       ;enable re & rei for encoder
        define M_SCR_DCD         '$12'       ;enable te & tei for decoder
```

BAD ORIGINAL

```
define DATABUFLEN       '512'   ;ancillary data input buffer length
define BITSPERBYTE      '8'     ;ancillary data in 8-bit bytes
define BITSFORPADDING   '3'     ;framed bit count for pad byte count

list
```

```
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\box_ctl.asm

; This file contains the definitions for the control variables for
; running the encoder and decoder for:

;  Digicast MiniCodec version of CCS CDQ1000:
;       sampling rate is 14.400 K - 225 Hz per sub-band (coded as 16 K sampling)
;       bit rate is 28.8 KBits per sec (coded as the low sampling rate)
;       the frame header is coded as 'fffc00'
;       Port B for the encoder and decoder is defined as a host port
;       encoder has its own phase lock detected on pc1 of Port C
;       decoder phase lock is detected on pc0 of Port C
;       ancillary data is NOT APPLICABLE

;define the bits required for Reed Solomon error correction

        define  REED_SOLOMON_BITS       '240'   ;8 bits - 30 Reed Solomon bytes

;define the choice pairs of input PCM sampling rates to make available

;!!!28.8
        define  SAMPLE_16K_AND_24K      '0'     ;choice of 14400 or 14400
        define  SAMPLE_16K_AND_24K      '0'     ;choice of 16000 or 24000
;
;!!!28.8
        define  SAMPLE_16K_AND_32K      '1'     ;choice of 16000 or 32000
        define  SAMPLE_16K_AND_48K      '2'     ;choice of 16000 or 48000
        define  SAMPLE_24K_AND_32K      '3'     ;choice of 24000 or 32000
        define  SAMPLE_24K_AND_48K      '4'     ;choice of 24000 or 48000
        define  SAMPLE_32K_AND_48K      '5'     ;choice of 32000 or 48000

;define the selected pair of input PCM sampling rates to make available

;!!!28.8
        define  SAMPLE_RATE_PAIR        '0'     ;14400 and 14400 sample rates
;!!!28.8

;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
;!!!28.8
        define  LOW_SAMPLE_RATE         '$000000'       ; 00 @ 14.4 KHz
        define  HIGH_SAMPLE_RATE        '$000000'       ; 00 @ 14.4 KHz
        define  FRAMESYNC_LO            '$fffc00'       ; fr sync pattern 14.4K
        define  FRAMESYNC_HI            '$fffc00'       ; fr sync pattern 14.4K
        define  LOW_SAMPLE_RATE_CCS     '$000000'  ; 00 @ 14.4(16) KHz
        define  HIGH_SAMPLE_RATE_CCS    '$000000'  ; 00 @ 14.4(16) KHz
        define  FRAMESYNC_LO_CCS        '$fffc00'  ; fr sync old CCS 14.4K(16)
        define  FRAMESYNC_HI_CCS        '$fffc00'  ; fr sync old CCS 14.4K(16)
        define  LOW_SAMPLE_RATE_ISO     '$000000'  ; 00 @ 14.4(16) KHz
        define  HIGH_SAMPLE_RATE_ISO    '$000000'  ; 00 @ 14.4(24) KHz
        define  FRAMESYNC_LO_ISO        '$fffc00'  ; fr sync MPEG-ISO 14.4K(16)
        define  FRAMESYNC_HI_ISO        '$fffc00'  ; fr sync MPEG-ISO 14.4K(24)
;!!!28.8
;!!!28.8        endif

;define the framing max tries for MUSICAM

        define  VERIFY_TRIES            '5'     ;verify found rates
```

BAD ORIGINAL

```
        define  MAX_BOOT_TRIES              '40'     ;for .96 seconds
        define  MAX_AUTO_TRIES              '80'     ;for 1.92 seconds

;define the power up wait times before going into processing

        define  XCODE_STARTUP               '1000'   ;1 second
        define  RDCDSYNT_STARTUP            '1000'   ;1 second

;define the memory layouts for any diagnostic memory testing:

;decoder memory layout:

        define  START_P_MEMORY_DCD          '1024'
        define  END_P_MEMORY_DCD            '2048'
        define  START_X_MEMORY_DCD          '40'
        define  END_X_MEMORY_DCD            '5120'
        define  START_Y_MEMORY_DCD          '128'
        define  END_Y_MEMORY_DCD            '1536'

        define  WATCH_DOG_TEST_DCD          '20'     ;20 millisecs for watch dog

;define the encoder/decoder overload scale factor code a scale facter
; lower than this value is considered an overload condition

        define  OVERLOAD_SKF    '5'

;define the controls to reframe if an excessive error condition persists
; A frequency count of frames out-of-frame or oof's (no sync pattern)
; and a frequency count of checksum bit errors are maintained.
; For every bad frame condition the appropriate counter is incremented at
; a given value and for every good frame the counter is decremented at
; a lower value than it was incremented. A tolerance limit is tested against
; the counter when an error is sensed to see if it is time to force reframing.
; By decrementing at an lower rate would allow a counter to reach the reframe
; limit when there is a persistant pattern of alternating or nearly alternating
; good frames and bad frames.

        define  GOOD_DECREMENT  '1'     ;good frame decrement value
        define  BAD_INCREMENT   '2'     ;error condition frame increment value
        define  BAD_LIMIT       '4'     ;out-of-frame (oof's) tolerance
        define  BAD_CRC_LIMIT   '10'    ;CRC-16 checksum bit error tolerance

;ben 3/8/94 (start): G722 modification for H221
; Hand shake definition (PBD)

        define  HSFTT   '#14'           ;PB14 input
        define  C0      '#9'            ;PB9 input
        define  C2      '#10'           ;PB10 input
        define  ABIT    '#12'           ;PB12 input
        define  HSTTF   '#13'           ;PB13 output

; Tx flag definition

        define  TX_FLAG '#0'            ;#0 bit of x:flag
        define  M64     '#1'            ;(PB1) M64 or M56 switch

;ben 3/8/94 (end): G722 modification for H221

;ben 3/21/95: decoder Reed Solomon address parameters
```

```
        define  RSReg1   '$8ff8'
        define  RSReg2   '$8ff9'
        define  RSReg3   '$8ffa'
        define  RSReg4   '$8ffb'
        define  RSReg5   '$8ffc'
        define  RSReg6   '$8ffd'
        define  RSReg7   '$8ffe'
        define  RSReg8   '$8fff'
        define  RSIN     '$fff8'
        define  RSOUT    '$eff8'

;define PORT C initializations

;  encoder PORT C Assignments
;
;  s = ssi port
;  i = input port
;  o = output port
;
;  8 - 7 6 5 4 - 3 2 1 0
;  s   s s s i   s o i o
;  1     e         8
;
;                       0101 = 5
; pc0 = eclksel (o)     ;select clock for Reed Solomon
; pc1 = eld (i)         ;phase lock detect (0=not locked, 1=locked)
; pc2 = rstrs (o)       ;reset Reed Solomon
; pc3 = ebclk (si)      ;bit clock
;
;                       0000 = 0
; pc4 = elrclk (i)      ;input pcm samples left/right clock
; pc5 = ewclk (si)      ;transmit word clock
; pc6 = eclk (si)       ;input samples word clock
; pc7 = esrdata (si)    ;input audio pcm sample data
;
;                       0000 = 0
; pc8 = etdata (so)     ;output MUSICAM frame data

        define  XCODE_PORT_C_M_PCC      'movep  #>$01e8,x:<<$FFE1'
        define  XCODE_PORT_C_M_PCD      'movep  #>$0004,x:<<$FFE5'
        define  XCODE_PORT_C_M_PCDDR    'movep  #>$0005,x:<<$FFE3'

;  decoder PORT C Assignments
;
;  s = ssi port
;  i = input port
;  o = output port
;
;  8 - 7 6 5 4 - 3 2 1 0
;  s   s s i s   s o o i
;  1     d         8
;
;                 0110 = 6
; pc0 = dld (i)         ;phase lock detect (0=not locked, 1=locked)
; pc1 = fclksel (o)     ;select clock for Reed Solomon
; pc2 = darst (o)       ;d-to-a reset line (0 = mute, 1 = audio)
; pc3 = dclk (si)       ;receive input frame data stream clock
;
;                 0000 = 0
; pc4 = dwclk (si)      ;transmit dac output audio word clock
```

```
; pc5 = dirclk (i)        ;transmit dac audio output left/right clock
; pc6 = dbclk (si)        ;decoder bit clock
; pc7 = drdata(si)        ;receive input musicam frame data
;
;                0000 = 0
; pc8 = dsdata (so)       ;transmit audio data output to dac

        define  RDECODE_PORT_C_M_PCC    'movep  #>$01d8,x:<<$FFE1'
        define  RDECODE_PORT_C_M_PCD    'movep  #>$0002,x:<<$FFE5'
        define  RDECODE_PORT_C_M_PCDDR  'movep  #>$0006,x:<<$FFE3'

;define PORT B initializations

;  encoder PORT B Assignments
;
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;
;;;; 14 13 12 - 11 10 9 8 - 7 6 5 4 - 3 2 1 0
;;;; 14 13 12 - 11 10 9 8 - 7 6 5 4 - 3 2 1 0
;;;;  i  i  i    o  i i o   o o o o   o o i i      **  MUSICAM **
;;;;  i  o  i    o  i i o   o o o o   o o i i      **  G722 **
;;;;;; i  o  i    o  i i o   o o o c   i o i i      **  G722 **
;;;;
;;;;                                1100 = c     ** MUSICAM **
;;;;;;                              0100 = 4     ** G722 **
;;;; pb0 = !lb (i)          ; loop back
;;;; pb1 = bitrate (i)      ; frame bit rate (0=low, 1=high)
;;;; pb2 = coding (o)       ; type of data input (0=MUSICAM, 1=G722)
;;;; pb3 = samprate (o)  ; PCM sampling rate (0=low, 1=high) ** MUSICAM **
;;;;;; pb3 = samprate (i); HSFTT flag for H221                 ** G722 **
;;;;
;;;;                                1111 = f
;;;; pb4 = emus (o)         ; encoder MUSICAM led (0=off, 1=lit)
;;;; pb5 = eovrld (o)       ; input pcm overload led (0=off, 1=lit alarm)
;;;; pb6 = e24k (o)         ; encoder phase lock loop led (0=off, 1=lit)
;;;; pb7 = wd2 (o)          ; watch dog timer
;;;;
;;;;                                1001 = 9
;;;; pb8 = cal (o)          ; analog-to-digital converter reset (0=normal, 1=reset
;;;; pb9 = e0 (i)           ; C0 flag for H221             ** G722 **
;;;; pb10 = e1 (i)          ; C2 flag for H221             ** G722 **
;;;; pb11 = era15 (o)       ;must be set to 1
;;;;
;;;;                                000 = 0    ** MUSICAM **
;;;;                                010 = 2    ** G722 **
;;;; pb12 = e3 (i)          ; ABIT flag for H221           ** G722 **
;;;; pb13 = e2 (i)          ; NOT USED                     ** MUSICAM **
;;;; pb13 = e2 (o)          ; HSTTF flag for H221          ** G722 **
;;;; pb14 = e4 (i)          ; NOT USED                     ** MUSICAM **
;;;;                        ; HSFTT flag for H221          ** G722 **
;;;;;; pb14 = e4 (i)        ; auto status of decoder: 0 go to low sampling/MUSICAM
;;;;;;                      ;                         1 follow above pins
;
;!!!Note: for Digicast port B is a host port
;       That means the previos definitions are not applicable.
;
; define port B as a host port

        define  XCODE_PORT_B_M_PBC      'movep  #>$0001,x:<<$FFE0'
```

```
;set data so that bara15 (bit 11) is 1

        define  XCODE_PORT_B_M_PBD        ';!!!Digicastmovep  #>$0800,x:<<$FFE4'

;set bit direction (output = 1 or input = 0)

;    ** MUSICAM **
        define  XCODE_PORT_B_M_PBDDR     ';!!!Digicastmovep  #>$09fc,x:<<$FFE2'
;    ** G722 **
        define  XADPCM_PORT_B_M_PBDDR    ';!!!Digicastmovep  #>$29fc,x:<<$FFE2'

;  decoder PORT B Assignments
;
;!!!Note: for Digicast port B is a host port
;     That means the following definitions are not applicable.
;
;;;; 14 13 12 - 11 10 9 8 - 7 6 5 4 - 3 2 1 0
;;;;  0  0  0    0  0 0 0   0 1 0 0   0 0 0 1     ** MUSICAM **
;;;;  0  1  0    0  0 0 0   0 1 0 0   0 0 0 1     ** G722 **
;;;;
;;;;
;;;;                              1110 = e
;;;; pb0 = ind (i)          ; ?????
;;;; pb1 = bitrate (o)      ; determined framing bit rate (0=low, 1=high)
;;;; pb2 = rcoding (o)      ; type of data to decode (0=MUSICAM, 1=G722)
;;;; pb3 = rsamprate (o);   determined sampling rate (0=low, 1=high)
;;;;;;                      ; HSFTT flag for H221                ** G722 **
;;;;
;;;;                              1011 = b
;;;; pb4 = N/C (o)          ; NO CONNECT
;;;; pb5 = N/C (o)          ; NO CONNECT
;;;; pb6 = ld (i)           ; phase lock loop detect (0=not locked, 1=locked)
;;;; pb7 = wdl (o)          ; watch dog timer
;;;;
;;;;                              1111 = f
;;;; pb8 = !darst (o)       ; digital-to-analog reset (1=normal, 0=reset)
;;;; pb9 = e0 (o)           ; C0 flag for H221                   ** G722 **
;;;; pb10 = e1 (o)          ; C2 flag for H221                   ** G722 **
;;;; pb11 = decra15 (o)     ; boot top (1) or bottom (0) if 512 chip
;;;;
;;;;                              111 = f    ** MUSICAM **
;;;;                              101 = d    ** G722 **
;;;; pb12 = e3 (o)          ; ABIT flag for H221                 ** G722 **
;;;; pb13 = e2 (o)          ; NOT USED                           ** MUSICAM **
;;;; pb13 = e2 (i)          ; HSTTF flag for H221                ** G722 **
;;;; pb14 = e4 (o)          ; NOT USED                           ** MUSICAM **
;;;;                        ; HSFTT flag for H221                ** G722 **
;;;;;; pb14 = e4 (o)        ; auto status: 0 NOT framed-encode low sampling/MUSICAM
;;;;;;                      ; 1 FRAMED

;rdcdsynt

;!!!Note: for Digicast port B is a host port
;     That means the previos definitions are not applicable.
;
; define port B as a host port

        define  RDECODE_PORT_B_M_PBC     'movep  #>$0001,x:<<$FFE0'
```

```
;set data so that bara15 (bit 11) is 1

        define  RDECODE_PORT_B_M_PBD     ';!!!Digicastmovep  #>$0800,x:<<$FFE4'
;   ** MUSICAM **
        define  RDECODE_PORT_B_M_PBDDR   ';!!!Digicastmovep  #>$ffbe,x:<<$FFE2'
;   ** G722 **
        define  FRADPCM_PORT_B_M_PBDDR   ';!!!Digicastmovep  #>$dfbe,x:<<$FFE2'

;define ssi port initialization for encoder and decoder

        define  XCODE_SSI_M_CRA          'movep  #>$6000,x:<<$FFEC'
        define  XCODE_SSI_M_CRB          'movep  #>$f010,x:<<$FFED'

        define  RDECODE_SSI_M_CRA        'movep  #>$6000,x:<<$FFEC'
        define  RDECODE_SSI_M_CRB        'movep  #>$f008,x:<<$FFED'

;define sci port initialization for encoder and decoder

        define  XCODE_SCI_M_SCR          'movep  #>$0002,x:<<$FFF0'
        define  RDECODE_SCI_M_SCR        'movep  #>$0002,x:<<$FFF0'

;define the setting dsp56002 clock (PLL Control Register)
;   8MHz crystal to run a 40 MHz (5 times 8, so code a 4 below)

        define  XCODE_M_PCTL             'movep #>$050004,x:<<$FFFD'
        define  RDECODE_M_PCTL           'movep #>$050004,x:<<$FFFD'
;
;**************************************************
;
;ENCODER hardware settings for leds and lines

;control the encoder devices:
; tested inputs of:
;
;  host vector 24
;       provides hardware and encoding parameters: none yet
;  host vector 2A
;       psycho table parameter id (0 - 31)
;  host vector 2C
;       psycho table parameter value for is from host vector 28
;
;                          y:<<$FFFF
; BRAD encode select data type          bit  0 (0=MUSICAM, 1=G722) sw1
; LO/HI encode sampling rate            bit  1 (0=high, 1=low) sw2
;;; CODAD decode select data type     ;;bit  2 (0=MUSICAM, 1=G722) sw3
;;; MUS/G722 decode sampling rate     ;;bit  3 (0=high, 1=low) sw4
; SRAD bit rate                         bit  4 (0=56Kbits, 1=64Kbits) sw5
;;; 32/48 not used                    ;;bit  5 (0=low, 1=high) sw6
; low bit encoder band width code       bit  8 (0=0, 1=1) sw 1 back panel
; high bit encoder band width code      bit  9 (0=0, 1=1) sw 2 back panel
; baud rate code low order bit          bit 10 (0=0, 1=1) sw 3 back panel
; baud rate code middle bit             bit 11 (0=0, 1=1) sw 4 back panel
; baud rate code high order bit         bit 12 (0=0, 1=1) sw 5 back panel
; CRC-16 OLD (0) or NEW (1) ISO         bit 13 (0=old, 1=new) sw 6 back panel
;
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;                          M_PBD (x:<<$FFE4)
; pb1 = bitrate (i)        bit  1 frame bit rate (0=low, 1=high)
; pb9 = e0 (i)             bit  9 C0 flag for H221 ** G722 **
```

```
; pb10 = e1 (i)            bit 10 C2 flag for H221 ** G722 **
; pb12 = e3 (i)            bit 12 ABIT flag for H221 ** G722 **
; pb13 = e2 (i)            bit 13 NOT USED  ** MUSICAM **
; pb14 = e4 (i)            bit 14 HSFFT flag for H221 ** G722 **
;
; set outputs of:
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;
;                          M_PBD (x:<<$FFE4)
; pb2 = coding (o)         bit 2 type of data input (0=MUSICAM, 1=G722)
; pb3 = samprate (o)       bit 3 PCM sampling rate (0=low, 1=high)
; pb4 = emus (o)           bit 4 MUSICAM encoding led (0=off, 1=lit alarm)
; pb5 = eovld (o)          bit 5 input pcm overload led (0=off, 1=lit alarm)
; pb6 = epllalm (o)        bit 6 encoding at low sampling led (0=off, 1=lit)
; pb7 = wd2 (o)            bit 7 watch dog timer
; pb8 = !cal (o)           bit 8 anal-to-digit converter reset (1=normal, 0=reset)
; pb11 = era15 (o)         bit 11 must be set to 1
; pb13 = e2 (o)            bit 13 HSTTF flag for H221 ** G722 **
;                          M_PBD (x:<<$FFE5)
; pc2 = eg722 (o)          bit 2 G722 encoding led (0=off, 1=lit alarm)
;
; leds across panel:
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;
;        1. MUSICAM encoding led:       x:<<$FFE4 bit 4 (amber)
;        2. G722 encoding led:          x:<<$FFE5 bit 2 (amber)
; N/A    9. main phase lock loop led:
;       10. encoder overload led:       x:<<$FFE4 bit 5 (red)
;       11. encoding low sampling led:  x:<<$FFE4 bit 6 (amber)

;!CAL: control the encoder analog-to-digital converter reset line

        define  SET_ADC_RESET                  ';bclr  #0,y:<not_appl'
        define  CLR_ADC_RESET                  ';bclr  #0,y:<not_appl'

; LD: test the MAIN phase lock loop detect

        define  LOCK_COUNT      '5'     ;5 successive locks set the lock led

        define  TST_SET_PHASE_LOCK_CD          'jset   #1,x:<<$FFE5'
        define  TST_CLR_PHASE_LOCK_CD          'jclr   #1,x:<<$FFE5'
        define  TST_ON_PHASE_LOCK_LED_XADPCM   'jset   #1,x:<<$FFE5'
        define  TST_OFF_PHASE_LOCK_LED_XADPCM  'jclr   #1,x:<<$FFE5'

;band-width:
; low order bit of band-width limit code
; high order bit of band-width limit code
;       codes:  00 = level 0 CDQ2000 standard band-widths
;               01 = level 1 CDQ2000 standard band-widths
;               10 = level 2 CDQ2000 standard band-widths
;               11 = level 3 CDQ2000 standard band-widths

        define  TST_SET_LOW_BAND_WIDTH_CD      'jclr   #0,y:<not_appl'
        define  TST_SET_HIGH_BAND_WIDTH_CD     'jclr   #0,y:<not_appl'
        define  TST_CLR_LOW_BAND_WIDTH_CD      'jclr   #0,y:<not_appl'
        define  TST_CLR_HIGH_BAND_WIDTH_CD     'jclr   #0,y:<not_appl'

TOGGLE_WATCH_DOG_CD macro
```

```
; encoder host interface watch dog tickle

;see what the host expects for a dog tickle and act accordingly
;  if bit M_HF0 (host i/f flag 0) of X:M_HSR (host status register) is set,
;       set bit M_HF2 (host i/f flag 2) of X:M_HCR (host control register)
;  else
;       clear bit M_HF2 (host i/f flag 2) of X:M_HCR (host control register).
;

        jset    #4,x:<<$FFE9,_watch_dog_00
        bset    #4,x:<<$FFE8
        jmp     <_watch_dog_10

_watch_dog_00
        bclr    #4,x:<<$FFE8

_watch_dog_10

        endm

INTERRUPT_HOST_CD macro

;wiggle host interrupt !HACK bit 14 of port b

        bset    #14,x:<<$FFE4
        nop
        nop
        movep   y:word_out,x:<<$FFEB    ;output leds for last frame
        nop
        nop
        bclr    #14,x:<<$FFE4

        endm

INIT_HOST_VECTORS_CD    macro

;initialize the encoder host vectors with start-up valid settings
;   since value is zero, use 30 sub-bands (6750 Hz)

        move    #>$0,x0
        move    x0,y:host24_word
        move    #>-1,x0
        move    x0,y:host2A_word
        move    #>$0,x0
        move    x0,y:host2C_word

        endm

GET_SWITCHES_CD macro LOOP

; copy switches received under host vector interrupt
;   bits 0-4 allow user set audio band width by specifying the upper
;   sub-band to be considered for bit allocation.
;   the range is from 4 (900 Hz) to 30 (6750 Hz)
;        Note: 30 is the default if the value is not within the range

        move    y:host24_word,x0
        move    x0,y:word_in
```

```
        endm

;BITRATE,low/high: get the selected bit rate

        define  TST_SET_LO_BIT_RATE_CD          'jclr   #0,y:<not_appl'
        define  TST_SET_HI_BIT_RATE_CD          'jclr   #0,y:<not_appl'

;CODAD,MUS/G722: get the selected type of decoder input data

        define  TST_SET_MUSICAM_DATA_CD         'jclr   #0,y:<word_in'
;!!!28.8
        define  TST_SET_G722_DATA_CD            'jset   #0,y:<not_appl'
        define  SET_MUSICAM_DATA_CD             ';bclr  #0,y:<not_appl'
        define  SET_G722_DATA_CD                ';bclr  #0,y:<not_appl'
;!!!28.8

;SDAD,LOW or HIGH: get the selected sampling rate
; choice pairings (A/B) are: 16/24 16/32 16/48 24/32 24/48 32/48

        define  TST_SET_LO_SAMPLE_RATE_CD       'jclr   #0,y:<not_appl'
        define  TST_SET_HI_SAMPLE_RATE_CD       'jclr   #0,y:<not_appl'
        define  SET_LO_SAMPLE_RATE_CD           ';bclr  #0,y:<not_appl'
;!!!28.8
        define  SET_HI_SAMPLE_RATE_CD           ';bclr  #0,y:<not_appl'
;!!!28.8

;MONSTERO: test whether mono or stereo framing selected

        define  TST_SET_MONO_STEREO_CD          'jclr   #0,y:<not_appl'
        define  TST_CLR_MONO_STEREO_CD          'jclr   #0,y:<not_appl'

;JOINTCE: test for joint stereo framing (if not mono selected above)

        define  TST_SET_JOINT_STEREO_CD         'jclr   #0,y:<not_appl'
        define  TST_CLR_JOINT_STEREO_CD         'jclr   #0,y:<not_appl'

;set which type ISO CRC-16 checksum OLD (0) or NEW (1)

        define  TST_SET_NEW_ISO_CRC_CD          'jclr   #0,y:<not_appl'
        define  TST_CLR_NEW_ISO_CRC_CD          'jclr   #0,y:<not_appl'

;E4: see if decoder is framed or force MUSICAM at LOW sampling rate

        define  TST_SET_DECODER_FRAMED_CD       'jclr   #0,y:<not_appl'
        define  TST_CLR_DECODER_FRAMED_CD       'jclr   #0,y:<not_appl'

;BR0,BR1,BR2: get the ancillary data baud rate

        define  TST_SET_LOW_BAUD_RATE_CD        'jclr   #0,y:<not_appl'
        define  TST_SET_MID_BAUD_RATE_CD        'jclr   #0,y:<not_appl'
        define  TST_SET_HIGH_BAUD_RATE_CD       'jclr   #0,y:<not_appl'
        define  TST_CLR_LOW_BAUD_RATE_CD        'jclr   #0,y:<not_appl'
        define  TST_CLR_MID_BAUD_RATE_CD        'jclr   #0,y:<not_appl'
        define  TST_CLR_HIGH_BAUD_RATE_CD       'jclr   #0,y:<not_appl'

;summary alarm relay: alarm relay associated with alarm LED

        define  SET_ALARM_RELAY_CD              ';bclr  #0,y:<not_appl'
        define  CLR_ALARM_RELAY_CD              ';bclr  #0,y:<not_appl'
        define  TST_SET_ALARM_RELAY_CD          'jclr   #0,y:<not_appl'
```

```
        define  TST_CLR_ALARM_RELAY_CD              ';jclr   #0,y:<not_appl'

;define state for all leds on and off for start-up

        define  OFF_LEDS_CD      '$000000'          ;off if bits set'
        define  ON_LEDS_CD       '$000000'          ;lit if bits clear'

;turn leds off:

        define  OFF_MUSICAM_LED_CD                  ';bclr   #0,y:<not_appl'
        define  OFF_G722_LED_CD                     ';bclr   #0,y:<not_appl'
        define  OFF_LOW_SAMPLING_LED_CD             ';bclr   #0,y:<not_appl'
        define  OFF_OVERLOAD_LED_CD                 'bclr    #1,y:<word_out'
        define  OFF_MONO_LED_CD                     ';bclr   #0,y:<not_appl'
        define  OFF_STEREO_LED_CD                   ';bclr   #0,y:<not_appl'
        define  OFF_JOINT_LED_CD                    ';bclr   #0,y:<not_appl'
        define  OFF_PHASE_LOCK_LED_CD               'bset    #0,y:<word_out'
        define  OFF_PHASE_LOCK_LED_XADPCM           ';bclr   #0,y:<not_appl'
        define  OFF_ALARM_LED_CD                    ';bclr   #0,y:<not_appl'
        define  OFF_BITALLOC_LED_CD                 ';bclr   #0,y:<not_appl'
        define  OFF_REED_SOL_LED_CD                 'bclr    #2,y:<word_out'

;turn leds on:

        define  ON_MUSICAM_LED_CD                   ';bclr   #0,y:<not_appl'
        define  ON_G722_LED_CD                      ';bclr   #0,y:<not_appl'
        define  ON_LOW_SAMPLING_LED_CD              ';bclr   #0,y:<not_appl'
        define  ON_OVERLOAD_LED_CD                  'bset    #1,y:<word_out'
        define  ON_MONO_LED_CD                      ';bclr   #0,y:<not_appl'
        define  ON_STEREO_LED_CD                    ';bclr   #0,y:<not_appl'
        define  ON_JOINT_LED_CD                     ';bclr   #0,y:<not_appl'
        define  ON_PHASE_LOCK_LED_CD                'bclr    #0,y:<word_out'
        define  ON_PHASE_LOCK_LED_XADPCM            ';bclr   #0,y:<not_appl'
        define  ON_ALARM_LED_CD                     ';bclr   #0,y:<not_appl'
        define  ON_BITALLOC_LED_CD                  ';bclr   #0,y:<not_appl'
        define  ON_REED_SOL_LED_CD                  'bset    #2,y:<word_out'

        define  SET_LEDS_CD         'movep  y:word_out,y:<<$FFFF'

;
;**************************************************
;
;DECODER hardware settings for leds and lines

;control the decoder devices:
;       phase lock loop signal line:     M_PBD bit 6

;control the decoder devices:
; tested inputs of:
;                        y:<<$FFFF
;;; BRAD encode select data type             ;;bit  0 (0=MUSICAM, 1=G722) sw1
;;; LO/HI encode sampling rate               ;;bit  1 (0=high, 1=low) sw2
; CODAD decode select data type                bit  2 (0=MUSICAM, 1=G722) sw3
; MUS/G722 decode sampling rate                bit  3 (0=high, 1=low) sw4
; SRAD decode bit rate                         bit  4 (0=56Kbits, 1=64Kbits) sw5
;;; 32/48 not used                           ;;bit  5 (0=low, 1=high) sw6
;;; low bit encoder band width code          ;;bit  8 (0=0, 1=1) sw 1 back panel
;;; high bit encoder band width code         ;;bit  9 (0=0, 1=1) sw 2 back panel
; baud rate code low order bit                 bit 10 (0=0, 1=1) sw 3 back panel
; baud rate code middle bit                    bit 11 (0=0, 1=1) sw 4 back panel
```

```
; baud rate code high order bit            bit 12 (0=0, 1=1  sw 5 back panel
;;; CRC-16 OLD  (0) or NEW (1) ISO       ;;bit 13 (0=old, 1=new, sw 5 back panel
;
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;                           M_PBD (x:<<$FFE4)
;                           M_PBD (x:<<$FFE4)
;  !LB loop back                          : bit 0 (1=not loop back, 0=loop back)
;   LD main phase lock loop signal line: bit 6 (1=lock 0=not)
;   E2 HSTTF flag for H221 ** G722 **    : bit 13
;
; set outputs of:
;!!!Note: for Digicast port B is a host port
;       That means the following definitions are not applicable.
;                           M_PBD (x:<<$FFE4)
;                           M_PBD (x:<<$FFE4)
; pb1 = bitrate (o)         bit  1 determined framing bit rate (0=low, 1=high)
; pb2 = coding (o)          bit  2 type of data to decode (0=MUSICAM, 1=G722)
; pb3 = samprate (o)        bit  3 determined sampling rate (0=low, 1=high
; pb4 = 32k (o)             bit  4 sampling rate low led-9 (0=off, 1=lit
; pb5 = 48k (o)             bit  5 sampling rate high led-10 (0=off, 1=lit
; pb7 = wdl (o)             bit  7 watch dog timer (0=clear, 1=set)
; pb8 = !darst (o)          bit  8 digital-to-analog reset (1=normal, 0=reset)
; pb9 = e0 (o)              bit  9 C0 flag for H221 ** G722 **
; pb10 = e1 (o)             bit 10 C2 flag for H221 ** G722 **
; pb11 = decra15 (o)        bit 11 boot top (1) or bottom (0) must be 1
; pb12 = e3 (o)             bit 12 ABIT flag for H221 ** G722 **
; pb13 = e2 (o)             bit 13 NOT USED  ** MUSICAM **
; pb14 = e4 (o)             bit 14 HSFFT flag for H221 ** G722 **
;                           M_PBD (x:<<$FFE5)
; pc2 = alrmrly (o)         bit 2 alarm relay
;
; leds across panel:
; encode 1. MUSICAM data led:            y:<<$FFFF bit 0 (amber) ***
; encode 2. G722 data led:               y:<<$FFFF bit 1 (amber) ***
;        3. MUSICAM frames led:          y:<<$FFFF bit 2 (amber)
;        4. G722 input data led:         y:<<$FFFF bit 3 (amber)
;        5. framing alarm led:           y:<<$FFFF bit 4 (red)
;        6. main phase lock loop led:    y:<<$FFFF bit 5 (green)
;        7. decoder overload led:        y:<<$FFFF bit 6 (red)
;        8. crc bit error led:           y:<<$FFFF bit 7 (red)
; encode 9. encoder overload led:        y:<<$FFFF bit 6 (red)   ***
; encde 10. main phase lock loop led:    y:<<$FFFF bit 5 (green) ***
; encde 11. low (1) vs hi (0) sampling: y:<<$FFFF bit 0 (amber) ***
;       12. low (1) vs hi (0) sampling: y:<<$FFFF bit 0 (amber)
;

;!CAL: control the decoder digital-to-analog converter reset line

        define  SET_DAC_RESET                   'bset   #2,x:<<$FFE5'
        define  CLR_DAC_RESET                   'bclr   #2,x:<<$FFE5'

;!LB: test the loop back

        define  TST_SET_LOOP_BACK_DCD           'jclr   #0,y:<not_appl'
        define  TST_CLR_LOOP_BACK_DCD           'jclr   #0,y:<not_appl'
        define  TST_SET_LOOP_BACK_FRADPCM       'jclr   #0,y:<not_appl'
        define  TST_CLR_LOOP_BACK_FRADPCM       'jclr   #0,y:<not_appl'

; LD: test the MAIN phase lock loop detect
```

```
        define  TST_SET_PHASE_LOCK_DCD          'jset   #0,x:<<$FFE5'
        define  TST_CLR_PHASE_LOCK_DCD          'jclr   #0,x:<<$FFE5'

TOGGLE_WATCH_DOG_DCD macro

; encoder host interface watch dog tickle

;see what the host expects for a dog tickle and act accordingly
;  if bit M_HF0 (host i/f flag 0) of X:M_HSR (host status register) is set,
;       set bit M_HF2 (host i/f flag 2) of X:M_HCR (host control register)
;  else
;       clear bit M_HF2 (host i/f flag 2) of X:M_HCR (host control register).
;

        jset    #4,x:<<$FFE9,_watch_dog_00
        bset    #4,x:<<$FFE8
        jmp     <_watch_dog_10

_watch_dog_00
        bclr    #4,x:<<$FFE8

_watch_dog_10

        endm

INTERRUPT_HOST_DCD macro

;wiggle host interrupt !HACK bit 14 of port b

        bset    #14,x:<<$FFE4
        nop
        nop
        movep   y:word_out,x:<<$FFEB    ;output leds for last frame
        nop
        nop
        bclr    #14,x:<<$FFE4

        endm

INIT_HOST_VECTORS_DCD   macro

;initialize the encoder host vectors with start-up valid settings

        move    #>$0,x0
        move    x0,y:host24_word

        endm

GET_SWITCHES_DCD macro LOOP

; copy switches received under host vector interrupt

        move    y:host24_word,x0
        move    x0,y:word_in

        endm

;BRAD,low/high: get the selected bit rate
```

```
        define  TST_SET_AUTO_BIT_RATE_DCD          'jclr   #0,y:<not_appl'
        define  TST_CLR_AUTO_BIT_RATE_DCD          'jclr   #0,y:<not_appl'
        define  TST_SET_AUTO_BIT_RATE_FRADPCM      'jclr   #0,y:<not_appl'
        define  TST_CLR_AUTO_BIT_RATE_FRADPCM      'jclr   #0,y:<not_appl'
        define  TST_SSET_AUTO_BIT_RATE_FRADPCM     'jclr   #0,y:<not_appl'
        define  TST_SCLR_AUTO_BIT_RATE_FRADPCM     'jclr   #0,y:<not_appl'
        define  TST_SET_LO_BIT_RATE_DCD            'jclr   #0,y:<not_appl'
        define  TST_SET_HI_BIT_RATE_DCD            'jclr   #0,y:<not_appl'
        define  TST_SET_LO_BIT_RATE_FRADPCM        'jclr   #0,y:<not_appl'
        define  TST_SET_HI_BIT_RATE_FRADPCM        'jclr   #0,y:<not_appl'
;!!!28.8
        define  SET_LO_BIT_RATE_DCD                ';bclr  #0,y:<not_appl'
        define  SET_HI_BIT_RATE_DCD                ';bclr  #0,y:<not_appl'
;!!!28.8

;CODAD,MUS/G722: get the selected type of decoder input data

        define  TST_SET_AUTO_CODED_DATA_DCD        'jclr   #0,y:<not_appl'
        define  TST_CLR_AUTO_CODED_DATA_DCD        'jclr   #0,y:<not_appl'
        define  TST_SET_AUTO_CODED_DATA_FRADPCM    'jclr   #0,y:<not_appl'
        define  TST_CLR_AUTO_CODED_DATA_FRADPCM    'jclr   #0,y:<not_appl'
        define  TST_SSET_AUTO_CODED_DATA_FRADPCM           'jsclr  #0,y:<not_appl'
        define  TST_SCLR_AUTO_CODED_DATA_FRADPCM           'jsclr  #0,y:<not_appl'
        define  TST_SET_MUSICAM_DATA_DCD           'jclr   #0,y:<not_appl'
        define  TST_SET_G722_DATA_DCD              'jclr   #0,y:<not_appl'
        define  TST_SET_MUSICAM_DATA_FRADPCM       'jclr   #0,y:<not_appl'
        define  TST_SET_G722_DATA_FRADPCM          'jclr   #0,y:<not_appl'
;!!!28.8
        define  SET_MUSICAM_DATA_DCD               ';bclr  #0,y:<not_appl'
        define  SET_G722_DATA_DCD                  ';bclr  #0,y:<not_appl'
;!!!28.8

;SDAD,low or high: get the selected sampling rate
; choice pairings (A/B) are: 16/24 16/32 16/48 24/32 24/48 32/48

        define  TST_SET_AUTO_SAMPLE_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_AUTO_SAMPLE_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_LO_SAMPLE_RATE_DCD         'jclr   #0,y:<not_appl'
        define  TST_SET_HI_SAMPLE_RATE_DCD         'jclr   #0,y:<not_appl'
;!!!28.8
        define  SET_LO_SAMPLE_RATE_DCD             ';bclr  #0,y:<not_appl'
        define  SET_HI_SAMPLE_RATE_DCD             ';bclr  #0,y:<not_appl'
;!!!28.8

;E4: inform the encoder:

        define  SET_DECODER_FRAMED_DCD             ';bclr  #0,y:<not_appl'

;DSW7: mute the decoder output

        define  TST_SET_MUTE_OUTPUT_DCD            'jclr   #0,y:<not_appl'
        define  TST_CLR_MUTE_OUTPUT_DCD            'jclr   #0,y:<not_appl'

;DSW8,DSW9: test the mono output channel requirements

        define  TST_SET_MONO_ONE_CHANNEL_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_MONO_ONE_CHANNEL_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_MONO_LEFT_OR_RIGHT_DCD     'jclr   #0,y:<not_appl'
        define  TST_CLR_MONO_LEFT_OR_RIGHT_DCD     'jclr   #0,y:<not_appl'
```

```
;to be activated sometime in CDQ1000

        define  TST_SET_FADE_OUTPUT_DCD         'jclr   #0,y:<not_appl'
        define  TST_CLR_FADE_OUTPUT_DCD         'jclr   #0,y:<not_appl'
        define  TST_SET_FADE_UP_DCD             'jclr   #0,y:<not_appl'
        define  TST_SET_FADE_DOWN_DCD           'jclr   #0,y:<not_appl'
        define  FADE_INCREMENT  '1'             ;2 Db per frame
        define  FADE_SOFTEST    '40'            ;max of down 80 Db
        define  FADE_START_UP   '20'            ;max of start up 40 Db
        define  FADE_FRAMES     '2'             ;fade every N frames

;LINSEL0,LINESEL1: test if line 1 and/or line 2 is selected

        define  TST_SET_LINE_1_SELECT_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_LINE_2_SELECT_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_LINE_1_SELECT_DCD       'jset   #0,y:<not_appl'
        define  TST_CLR_LINE_2_SELECT_DCD       'jset   #0,y:<not_appl'

;DIAGNOST (ANCELDTA): test whether diagnostics programming is to be executed

        define  TST_SET_DIAGNOSTICS_DCD         'jclr   #0,y:<not_appl'
        define  TST_CLR_DIAGNOSTICS_DCD         'jclr   #0,y:<not_appl'

;BR0,BR1,BR2: get the ancillary data baud rate

        define  TST_SET_LOW_BAUD_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_MID_BAUD_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_HIGH_BAUD_RATE_DCD      'jclr   #0,y:<not_appl'
        define  TST_CLR_LOW_BAUD_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_MID_BAUD_RATE_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_HIGH_BAUD_RATE_DCD      'jclr   #0,y:<not_appl'

;BR0,BR1,BR2: get diagnostics code when DIAGNOST (currently ANCELDTA) is set
; dip switch interpretations for diagnostic operation

        define  TST_SET_LOW_DIAG_CODE_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_MID_DIAG_CODE_DCD       'jclr   #0,y:<not_appl'
        define  TST_SET_HIGH_DIAG_CODE_DCD      'jclr   #0,y:<not_appl'
        define  TST_CLR_LOW_DIAG_CODE_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_MID_DIAG_CODE_DCD       'jclr   #0,y:<not_appl'
        define  TST_CLR_HIGH_DIAG_CODE_DCD      'jclr   #0,y:<not_appl'

;summary alarm relay: alarm relay associated with alarm LED

        define  SET_ALARM_RELAY_DCD             ';bclr  #0,y:<not_appl'
        define  CLR_ALARM_RELAY_DCD             ';bclr  #0,y:<not_appl'
        define  TST_SET_ALARM_RELAY_DCD         'jclr   #0,y:<not_appl'
        define  TST_CLR_ALARM_RELAY_DCD         'jclr   #0,y:<not_appl'

;define state for all leds on and off for start-up

        define  OFF_LEDS_DCD    '$00'   ;off if bits set'
        define  ON_LEDS_DCD     '$ff'   ;lit if bits clear'

;turn leds off:

        define  OFF_FRAME_LED_DCD               'bclr   #1,y:<word_out'
        define  OFF_CRC_ERROR_LED_DCD           'bclr   #2,y:<word_out'
        define  OFF_OVERLOAD_LED_DCD            'bclr   #3,y:<word_out'
        define  OFF_PHASE_LOCK_LED_DCD          'bset   #4,y:<word_out'
```

```
        define  OFF_REED_SOL_LED_DCD            'bclr   #5,y:<word_out'

        define  OFF_LO_BIT_RATE_LED_DCD         ';bclr  #0,y:<not_appl'
        define  OFF_HI_BIT_RATE_LED_DCD         ';bclr  #0,y:<not_appl'
        define  OFF_MUSICAM_LED_DCD             ';bclr  #0,y:<not_appl'
        define  OFF_G722_LED_DCD                ';bclr  #0,y:<not_appl'
        define  OFF_PHASE_LOCK_LED_FRADPCM      ';bclr  #0,y:<not_appl'
OFF_PHASE_LOCK_LED_MACRO_FRADPCM macro
        bclr    #5,x:<Eram_Mem                  ;turn off red led
        move    x:<Eram_Mem,x0
        movep   x0,y:<<$FFFF
        endm
OFF_OVERLOAD_LED_MACRO_FRADPCM macro
        bclr    #6,x:<Eram_Mem          ;turn off overload led
        movep   x:Eram_Mem,y:<<$FFFF
        endm
        define  OFF_LO_SAMPLE_RATE_LED_DCD      ';bclr  #0,y:<not_appl'
        define  OFF_HI_SAMPLE_RATE_LED_DCD      ';bclr  #0,y:<not_appl'
        define  OFF_MONO_LED_DCD                ';bclr  #0,y:<not_appl'
        define  OFF_STEREO_LED_DCD              ';bclr  #0,y:<not_appl'
        define  OFF_JOINT_LED_DCD               ';bclr  #0,y:<not_appl'
        define  OFF_ALARM_LED_DCD               ';bclr  #0,y:<not_appl'

;turn leds on:

        define  ON_FRAME_LED_DCD                'bset   #1,y:<word_out'
        define  ON_CRC_ERROR_LED_DCD            'bset   #2,y:<word_out'
        define  ON_OVERLOAD_LED_DCD             'bset   #3,y:<word_out'
        define  ON_PHASE_LOCK_LED_DCD           'bclr   #4,y:<word_out'
        define  ON_REED_SOL_LED_DCD             'bset   #5,y:<word_out'

        define  ON_LO_BIT_RATE_LED_DCD          ';bclr  #0,y:<not_appl'
        define  ON_HI_BIT_RATE_LED_DCD          ';bclr  #0,y:<not_appl'
        define  ON_MUSICAM_LED_DCD              ';bclr  #0,y:<not_appl'
        define  ON_G722_LED_DCD                 ';bclr  #0,y:<not_appl'
        define  ON_PHASE_LOCK_LED_FRADPCM       ';bclr  #0,y:<not_appl'
ON_PHASE_LOCK_LED_MACRO_FRADPCM macro
        bset    #5,x:<Eram_Mem                  ;turn on red led
        move    x:<Eram_Mem,x0
        movep   x0,y:<<$FFFF
        endm
ON_OVERLOAD_LED_MACRO_FRADPCM macro
        bset    #6,x:<Eram_Mem          ;turn on overload led
        movep   x:Eram_Mem,y:<<$FFFF
        endm
        define  ON_LO_SAMPLE_RATE_LED_DCD       ';bclr  #0,y:<not_appl'
        define  ON_HI_SAMPLE_RATE_LED_DCD       ';bclr  #0,y:<not_appl'
        define  ON_MONO_LED_DCD                 ';bclr  #0,y:<not_appl'
        define  ON_STEREO_LED_DCD               ';bclr  #0,y:<not_appl'
        define  ON_JOINT_LED_DCD                ';bclr  #0,y:<not_appl'
        define  ON_ALARM_LED_DCD                ';bclr  #0,y:<not_appl'

        define  SET_LEDS_DCD            'movep  y:word_out,y:<<$FFFF'

        define  TST_SET_CRC_ERROR_DCD           'jclr   #0,y:<not_appl'
        define  TST_CLR_CRC_ERROR_DCD           'jclr   #0,y:<not_appl'

;define macros for getting the encoder and decoder external switches

GET_BIT_RATE_CD macro
```

```
; encoder interpret the external switches for the framing bit rate

        move    #>RATE_LO,x0            ;start with lower KBit rate
;!!!28.8: force low bit rate
;!!!    TST_SET_LO_BIT_RATE_CD,_grte_a
;!!!    move    #>RATE_HI,x0            ;otherwise, use higher KBit rate
;!!!
;!!!_grte_a
        move    x0,x:tstrate            ;set selected rate

        endm

GET_FRAME_TYPE_CD macro

; micro encoder only handles mono frame type

        move    #>MONO,x0
        move    x0,x:tstfrme

;;; determine the NEW or OLD ISO CRC-16 specification
;;
;;      bclr    #CRC_OLD_vs_NEW,y:<stereo  ;0=OLD ISO specification
                                           ;1=NEW ISO specification
;;
;;      TST_CLR_NEW_ISO_CRC_CD,_gtyp_a     ;if not use NEW CRC, done
;;
; MiniCodec board FORCE new ISO crc

        bset    #CRC_OLD_vs_NEW,y:<stereo  ;1=NEW ISO specification

;;;_gtyp_a

; default to old CCS CDQ1000's

        bset    #0,x:tstoccs            ;1=old CCS CDQ2000's

        endm

GET_CODE_TYPE_CD macro

; encoder interpret the external switches for the type of coded output
;       MUSICAM frames or G722

;!!!28.8: force MUSICAM
;!!!    TST_SET_MUSICAM_DATA_CD,_gcde_a
;!!!    bset    #0,x:tstcode            ;indicate G722 output
;!!!    OFF_MUSICAM_LED_CD              ;turn off MUSICAM indicator
;!!!    OFF_LOW_SAMPLING_LED_CD         ;turn off low sampling rate indicator
;!!!    ON_G722_LED_CD                  ;turn on G722 indicator
;!!!    SET_G722_DATA_CD                ;set line for encoder G722
;!!!    jmp     <_gcde_b

;!!!_gcde_a
        ON_MUSICAM_LED_CD               ;turn on MUSICAM indicator
        OFF_G722_LED_CD                 ;turn off G722 indicator
        SET_MUSICAM_DATA_CD             ;set line for encoder MUSICAM

;!!!_gcde_b
        endm
```

```
GET_SAMPLE_RATE_CD macro

; micro encoder handles low and high sampling rates

;!!!28.8: force low sample rate
;!!!     TST_SET_LO_SAMPLE_RATE_CD,_gsmp_a
;!!!     bset    #0,x:tstsmpl             ;indicate high K sampling rate
;!!!     OFF_LOW_SAMPLING_LED_CD          ;turn off low sampling rate indicator
;!!!     SET_HI_SAMPLE_RATE_CD            ;set line for high sampling rate
;!!!     jmp     <_gsmp_b
;!!!
;!!!_gsmp_a
;!!!     TST_SET_G722_DATA_CD,_gsmp_b     ;do not turn on if G722
         ON_LOW_SAMPLING_LED_CD           ;turn on low sampling rate indicator
         SET_LO_SAMPLE_RATE_CD            ;set line for low sampling rate

_gsmp_b
         endm

GET_BAND_WIDTH_CD macro

; encoder interpret the external switches for the band-width code
;  to set band-width based on frame bit rate and type of framing

;!!!     TST_CLR_LOW_BAND_WIDTH_CD,_gbnd_a ;check switch to interpret as 0
;!!!     bset    #0,x:tstband             ;set the band width code low bit on
;!!!
;!!!_gbnd_a
;!!!     TST_CLR_HIGH_BAND_WIDTH_CD,_gbnd_b ;check switch to interpret as 0
;!!!     bset    #1,x:tstband             ;set the band width code high bit on
;!!!
;!!!_gbnd_b

;   bits 0-4 allow user set audio band width by specifying the upper
;   sub-band to be considered for bit allocation.
;   the range is from 4 (900 Hz) to 30 (6750 Hz)
;       Note: 30 is the default if the value is not within the range

;!!!     move    y:word_in,x0             ;get sub-bands for y:<usedsb
;!!!     move    x0,x:tstband             ;put value in the new i/p
;!!!     move    x0,y:bndwdth             ;& put value in the current

         endm

GET_BAUD_RATE_CD macro

; encoder interpret the external switches to get ancillary data baud rate

;!!!     TST_CLR_LOW_BAUD_RATE_CD,_gbaud_a ;check switch to interpret as 0
;!!!     bset    #0,x:tstbaud             ;set the baud rate low bit on
;!!!
;!!!_gbaud_a
;!!!     TST_CLR_MID_BAUD_RATE_CD,_gbaud_b ;check switch to interpret as 0
;!!!     bset    #1,x:tstbaud             ;set the baud rate middle bit on
;!!!
;!!!_gbaud_b
;!!!     TST_CLR_HIGH_BAUD_RATE_CD,_gbaud_c ;check switch to interpret as 0
;!!!     bset    #2,x:tstbaud             ;set the baud rate high bit on
;!!!
;!!!_gbaud_c
```

BAD ORIGINAL

```
        endm

; decoder external switch macros

GET_BIT_RATE_DCD macro

; decoder interpret the external switches for the framing bit rate

; begin with raw code for lower framing bit rate, clear auto select flag

        move    #>RATE_LO,x0
;!!!28.8: force low bit rate
;!!!    bclr    #AUTO_SELECT_BIT_RATE,y:<ctlflgs
;!!!    move    #autorate,r0            ;addr of curr bit auto select state
;!!!
;!!!; if not auto select switch is set, go by the selected switch setting
;!!!
;!!!    TST_CLR_AUTO_BIT_RATE_DCD,_grte_c ;if not auto select, test other sw
;!!!
;!!!;if in loop back, set the bit rate to high Kbits
;!!!
;!!!;   TST_CLR_LOOP_BACK_DCD,_grte_a   ;if not loop, continue
;!!!;   move    #>RATE_HI,x0            ;set higher KBits raw code
;!!!;   jmp     <_grte_e                ;install chosen bit rate
;!!!;
;!!!;_grte_a
;!!!
;!!!;see if already in auto select bit rate
;!!!
;!!!    jset    #0,x:(r0),_grte_b       ;if already in auto, skip next 2 stmts
;!!!
;!!!;set save code as in auto select bit rate and indicate switch changes
;!!!
;!!!    bset    #0,x:(r0)               ;bit 0 = 1 = AUTO SELECT
;!!!    bset    #4,y:<not_appl          ;indicate a switch change
;!!!
;!!!_grte_b
;!!!
;!!!;set control flag to perform auto select of bit rate
;!!!
;!!!    bset    #AUTO_SELECT_BIT_RATE,y:<ctlflgs
;!!!    bset    #0,x:autosel
;!!!    move    y:frmrate,x0            ;use last rate to start
;!!!    jmp     <_grte_e
;!!!
;!!!; set the bit rate as selected by the switch
;!!!
;!!!_grte_c
;!!!
;!!!;see if currently in auto select bit rate
;!!!
;!!!    jclr    #0,x:(r0),_grte_d       ;if not in auto, skip next 2 stmts
;!!!
;!!!;clear save code as NOT in auto select bit rate and indicate switch changes
;!!!
;!!!    bclr    #0,x:(r0)               ;bit 0 = 0 = NOT AUTO SELECT
;!!!    bset    #4,y:<not_appl          ;indicate a switch change
;!!!
;!!!_grte_d
```

```
;!!!
;!!!;see if low or high bit rate selected, if 0, keep lower Kbit rate
;!!!
;!!!     TST_SET_LO_BIT_RATE_DCD,_grte_e
;!!!     move      #>RATE_HI,x0              ;otherwise, use higher KBit rate
;!!!
;!!!_grte_e
         move      x0,x:tstrate              ;set selected rate

         endm

GET_FRAME_TYPE_DCD macro

; decoder interpret the external switches for the frame type
;        (not applicable)
; however, set the current mono frame output channel parameter

; clear the mono out both channels flag and set the flag if needed

         bset      #MONO_OUT_BOTH,y:<ctlflgs        ;mono out both channels
         TST_CLR_MONO_ONE_CHANNEL_DCD,_gfrm_a
         bclr      #MONO_OUT_BOTH,y:<ctlflgs        ;mono out one channel

_gfrm_a

; clear the mono output one channel flag indicating LEFT
;        and set the flag to the RIGHT channel if needed

         bclr      #MONO_OUT_CHANNEL,y:<ctlflgs     ;mono one channel out LEFT
         TST_CLR_MONO_LEFT_OR_RIGHT_DCD,_gfrm_b
         bset      #MONO_OUT_CHANNEL,y:<ctlflgs     ;mono one channel out RIGHT

_gfrm_b

         endm

GET_CODE_TYPE_DCD macro

; decoder interpret the external switches for the type of coded input
;        MUSICAM frames or G722

; starts out as MUSICAM (default), clear auto select flag

;!!!28.8: force MUSICAM
;!!!     bclr      #AUTO_SELECT_DATA_TYPE,y:<ctlflgs
;!!!     move      #autocode,r0
;!!!
;!!!; if not auto select switch is set, go by the selected switch setting
;!!!
;!!!     TST_CLR_AUTO_CODED_DATA_DCD,_gcde_b
;!!!
;!!!;if in loop back, leave the data type as MUSICAM
;!!!;
;!!!;    TST_SET_LOOP_BACK_DCD,_gcde_d   ;if in loop, done selection
;!!!
;!!!;see if already in auto select code type
;!!!
;!!!     jset      #0,x:(r0),_gcde_a        ;if already in auto, skip next 2 stmts
;!!!
;!!!;set save code as in auto select code type and indicate switch changes
```

```
;!!!
;!!!    bset    #0,x:(r0)               ;bit 0 = 1 = AUTO SELECT
;!!!    bset    #4,y:<not_appl          ;indicate a switch change
;!!!
;!!!_gcde_a
;!!!
;!!!;set control flag to perform auto select of bit rate
;!!!
;!!!    bset    #AUTO_SELECT_DATA_TYPE,y:<ctlflgs
;!!!    bset    #0,x:autosel
;!!!
;!!!; set to auto select, continue with previous type of coded data
;!!!
;!!!    move    y:iputcde,x0
;!!!    move    x0,x:tstcode            ;indicate last input type
;!!!    jmp     <_gcde_d
;!!!
;!!!_gcde_b
;!!!
;!!!;see if currently in auto select code type
;!!!
;!!!    jclr    #0,x:(r0),_gcde_c       ;if not in auto, skip next 2 stmts
;!!!
;!!!;clear save code as NOT in auto select code type and indicate switch changes
;!!!
;!!!    bclr    #0,x:(r0)               ;bit 0 = 0 = NOT AUTO SELECT
;!!!    bset    #4,y:<not_appl          ;indicate a switch change
;!!!
;!!!_gcde_c
;!!!    TST_SET_MUSICAM_DATA_DCD,_gcde_d
;!!!    bset    #0,x:tstcode            ;indicate G722 input
;!!!
;!!!_gcde_d
;!!!
;!!!;;;indicate the switch selection to encoder for data type
;!!!;;
;!!!;;  TST_SET_ENCODE_G722_DATA_DCD,_gcde_e    ;if G722, set that for encoder
;!!!;;  SET_ENCODE_MUSICAM_DATA_DCD             ;tell encoder MUSICAM
;!!!;;  jmp     <_gcde_f
;!!!;;
;!!!;;_gcde_e
;!!!;;  SET_ENCODE_G722_DATA_DCD                ;tell encoder G722
;!!!;;
;!!!;;_gcde_f
        endm

GET_SAMPLE_RATE_DCD macro

; decoder interpret the external switches for the sampling rate
; if select switch is set, see which type of coded data is being input

; begin with the code for low sampling KHz rate, clear auto select flag

        move    #0,x0
;!!!28.8: force low sample rate
;!!!    bclr    #AUTO_SELECT_SAMPLE_RATE,y:<ctlflgs
;!!!    move    #autosmpl,r0
;!!!
;!!!; if not auto select switch is set, go by the selected switch setting
;!!!
```

```
;!!!!   TST_CLR_AUTO_SAMPLE_RATE_DCD,_gsmp_b ;if not auto select, test other sw
;!!!!
;!!!!;if in loop back, leave the low sampling rate selected
;!!!!;
;!!!!;   TST_SET_LOOP_BACK_DCD,_gsmp_d   ;if in loop, done selection
;!!!!
;!!!!;see if already in auto select sampling rate
;!!!
;!!!     jset    #0,x:(r0),_gsmp_a          ;if already in auto, skip next 2 stmts
;!!!
;!!!!;set save code as in auto select sampling rate and indicate switch changes
;!!!!
;!!!     bset    #0,x:(r0)                  ;bit 0 = 1 = AUTO SELECT
;!!!     bset    #4,y:<not_appl             ;indicate a switch change
;!!!
;!!!_gsmp_a
;!!!
;!!!;set control flag to perform auto select of sampling rate
;!!!
;!!!     bset    #AUTO_SELECT_SAMPLE_RATE,y:<ctlflgs
;!!!     bset    #0,x:autosel
;!!!     move    y:smplrte,x0               ;use last sampling rate to start
;!!!     jmp     <_gsmp_d
;!!!
;!!!; set the sampling rate as selected by the switch
;!!!
;!!!_gsmp_b
;!!!
;!!!;see if currently in auto select sampling rate
;!!!
;!!!     jclr    #0,x:(r0),_gsmp_c          ;if not in auto, skip next 2 stmts
;!!!
;!!!;clear save code as NOT in auto select sampling rate and indicate switch cha
;!!!
;!!!     bclr    #0,x:(r0)                  ;bit 0 = 0 = NOT AUTO SELECT
;!!!     bset    #4,y:<not_appl             ;indicate a switch change
;!!!
;!!!_gsmp_c
;!!!     TST_SET_LO_SAMPLE_RATE_DCD,_gsmp_d
;!!!     move    #>1,x0                     ;otherwise, use high rate
;!!!
;!!!_gsmp_d
         move    x0,x:tstsmpl

;!!!!;;indicate the switch selection to encoder for data sampling rate
;!!!!;
;!!!!;    TST_SET_ENCODE_HI_SAMP_RATE_DCD,_gsmp_e ;if high rate, set for encoder
;!!!!;    SET_ENCODE_LO_SAMPLE_RATE_DCD           ;tell encoder low sampling rate
;!!!!;    jmp     <_gsmp_f
;!!!!;
;!!!!;_gsmp_e
;!!!!;    SET_ENCODE_HI_SAMPLE_RATE_DCD           ;tell encoder high sampling rate
;!!!!;
;!!!!;_gsmp_f
         endm

GET_BAUD_RATE_DCD macro

; decoder interpret the external switches to get ancillary data baud rate
```


BAD ORIGINAL

```
;!!!    TST_CLR_LOW_BAUD_RATE_DCD,_gbaud_a ;check switch to interpret as 0
;!!!    bset    #0,x:tstbaud              ;set the baud rate low bit on
;!!!
;!!!_gbaud_a
;!!!    TST_CLR_MID_BAUD_RATE_DCD,_gbaud_b ;check switch to interpret as 0
;!!!    bset    #1,x:tstbaud              ;set the baud rate middle bit on
;!!!
;!!!_gbaud_b
;!!!    TST_CLR_HIGH_BAUD_RATE_DCD,_gbaud_c ;check switch to interpret as 0
;!!!    bset    #2,x:tstbaud              ;set the baud rate high bit on
;!!!
;!!!_gbaud_c

        endm

GET_METHOD_OPERATION_DCD macro

; decoder get external switches for method of operation: NORMAL vs DIAGNOSTIC

        endm

GET_DIAGNOSTICS_DCD macro

; decoder get external switches for diagnostic operation: NORMAL vs DIAGNOSTIC

;!!!; if switch set for normal operation, skip rest of this interpretation
;!!!
;!!!    TST_CLR_DIAGNOSTICS_DCD,_gdiag_c ;switch set for normal or diagnostics
;!!!
;!!!; set the diagnostic code bits
;!!!
;!!!    TST_CLR_LOW_DIAG_CODE_DCD,_gdiag_a ;check switch to interpret as 0
;!!!    bset    #0,x:tstmeth              ;set diagnostic code low bit on
;!!!
;!!!_gdiag_a
;!!!    TST_CLR_MID_DIAG_CODE_DCD,_gdiag_b ;check switch to interpret as 0
;!!!    bset    #1,x:tstmeth              ;set diagnostic code middle bit on
;!!!
;!!!_gdiag_b
;!!!    TST_CLR_HIGH_DIAG_CODE_DCD,_gdiag_c ;check switch to interpret as 0
;!!!    bset    #2,x:tstmeth              ;set diagnostic code high bit on
;!!!
;!!!_gdiag_c

        endm

VERIFY_AUTO_SAMPLE macro

;!!!Digicast: NOT APPLICABLE

        endm

;for CDQ2012 start with flag set to decode MPEG-ISO frames:
;       bit 0:  0 = MPEG-ISO
;               1 = old CCS CDQ's
;       bit 0:  0 = MPEG-ISO at 24000 sampling
;               1 = old CDQ1000 (MICRO) frames at 24000 sampling

TOO_MANY_SYNC_ERRORS_DCD macro
```

```
;how to handle the set of the REFRAME flag after too many successive
;  sync pattern failures
;    always do old CCS CDQ's

        bset    #0,y:oldccs                 ;only handle old CCS CDQ's
        bset    #1,y:oldccs                 ;old CCS CDQ frms @ 14.4 K sampl
        jmp     <restart                    ;restart, as old CCS CDQ's

        endm

TOO_MANY_BIT_ERRORS_DCD macro

;how to handle the set of the REFRAME flag after too menay successive
;  CRC-16 bit errors
;    if the oldccs bit is not set, switch from MPEG-ISO to old CCS CDQ's
;    if old CCS has already been tried, restore MPEG-ISO and reframe

        move    #oldccs,r0                  ;to test oldccs flag (bit 0)
        nop                                 ;  0 = MPEG-ISO
                                            ;  1 = old CCS
_old_ccs

;try decoding frames from older CCS CDQ's units

        bset    #0,y:oldccs                 ;set old CCS flag
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        jmp     <reframe                    ;reframe, try old CCS

        endm

;This code handles the special ancillary data problem when frames have
;  too many encoded according to the decoder baud rate and the frames also
;  have the old ISO (CCS) CRC-16 checksum algorithm for protection.
;  This condition occurs when trying to determine if the stream of frames is
;  from an old CCS CDQ2000 and are two channel frames at low bit rates or is
;  the stream from a new CCS CDQ with MPEG-ISO frames but are protected
;  using the old ISO (CCS) CRC-16 algorithm.

TOO_MANY_DATA_ERRORS_DCD macro

;old CDQ1000 mono frames @ 24000 sampling do not apply to this problem

        jset    #1,y:(r1),_tdata_10         ;if old CDQ1000, skip over to continue

;if too many errors, reframe using the opposite old CCS vs MPEG-ISO with
;  low bit rate two channel frames

        jset    #0,y:(r1),_tdata_00         ;if doing old CCS, go switch to ISO
        bset    #0,y:oldccs                 ;switch to try old CCS decoding
        jmp     <reframe                    ;reframe

_tdata_00
        bclr    #0,y:oldccs                 ;switch to try MPEG-ISO decoding
        jmp     <restart                    ;restart
```

```
_tdata_10

        endm

;define ancillary data baud rates and max byte counts per frame:
;!!!28.8
;       14400 sampling rate @ 80 msecs
;!!!28.8
;       16000 sampling rate @ 72 msecs
;       24000 sampling rate @ 48 msecs
;       32000 sampling rate @ 36 msecs
;       48000 sampling rate @ 24 msecs
;   (baud rate * milliseconds = bits received
;    bits received then promoted to next even 8-bits to yeild max bytes)

;M_SCCRnnn (see pages 11-22 & 11-31) =
;
;     ((32,000,000 / (64 * nnn )) - 1) (result rounded & converted to hex)
;    where 32,000,000 is crystal, nnn = baud rate

        define BAUD300          '0'     ;dip switch code for 300 baud
        define M_SCCR300        '$682'  ;set clock for 300 baud rate
;!!!28.8
        define BYTES300_16      '3'     ;3 bytes (24.0 bits ==> 24 bits)
        define BYTES300_24      '3'     ;3 bytes (24.0 bits ==> 24 bits)
;       define BYTES300_16      '3'     ;3 bytes (21.6 bits ==> 24 bits)
;       define BYTES300_24      '2'     ;2 bytes (14.4 bits ==> 16 bits)
;!!!28.8
        define BYTES300_32      '2'     ;2 bytes (10.8 bits ==> 16 bits)
        define BYTES300_48      '1'     ;1 byte (7.2 bits ==> 8 bits)

        define BAUD1200         '1'     ;dip switch code for 1200 baud
        define M_SCCR1200       '$1a0'  ;set clock for 1200 baud rate
;!!!28.8
        define BYTES1200_16     '12'    ;11 bytes (96.0 bits ==> 96 bits)
        define BYTES1200_24     '12'    ;12 bytes (96.0 bits ==> 96 bits)
;       define BYTES1200_16     '11'    ;11 bytes (86.4 bits ==> 88 bits)
;       define BYTES1200_24     '8'     ;8 bytes (57.6 bits ==> 64 bits)
;!!!28.8
        define BYTES1200_32     '6'     ;6 bytes (43.2 bits ==> 48 bits)
        define BYTES1200_48     '4'     ;4 bytes (28.8 bits ==> 32 bits)

        define BAUD2400         '2'     ;dip switch code for 2400 baud
        define M_SCCR2400       '$cf'   ;set clock for 2400 baud rate
;!!!28.8
        define BYTES2400_16     '24'    ;24 bytes (192.0 bits ==> 192 bits)
        define BYTES2400_24     '24'    ;24 bytes (192.0 bits ==> 192 bits)
;       define BYTES2400_16     '22'    ;22 bytes (172.8 bits ==> 176 bits)
;       define BYTES2400_24     '15'    ;15 bytes (115.2 bits ==> 120 bits)
;!!!28.8
        define BYTES2400_32     '11'    ;11 bytes (86.4 bits ==> 88 bits)
        define BYTES2400_48     '8'     ;8 bytes (57.6 bits ==> 64 bits)

        define BAUD3600         '3'     ;dip switch code for 3600 baud
        define M_SCCR3600       '$8a'   ;set clock for 3600 baud rate
;!!!28.8
        define BYTES3600_16     '36'    ;36 bytes (288.0 bits ==> 288 bits
        define BYTES3600_24     '36'    ;36 bytes (288.0 bits ==> 288 bits)
;       define BYTES3600_16     '33'    ;33 bytes (259.2 bits ==> 264 bits
```

```
;       define BYTES3600_24     '22'    ;22 bytes (172.8 bits ==> 176 bits
;!!!28.8
        define BYTES3600_32     '17'    ;17 bytes (129.6 bits ==> 136 bits)
        define BYTES3600_48     '11'    ;11 bytes (86.4 bits ==> 88 bits)

        define BAUD4800         '4'     ;dip switch code for 4800 baud
        define M_SCCR4800       '$68'   ;set clock for 4800 baud rate
;!!!28.8
        define BYTES4800_16     '48'    ;48 bytes (384.0 bits ==> 384 bits)
        define BYTES4800_24     '48'    ;48 bytes (384.0 bits ==> 384 bits)
;       define BYTES4800_16     '44'    ;44 bytes (345.6 bits ==> 352 bits)
;       define BYTES4800_24     '29'    ;29 bytes (230.4 bits ==> 232 bits)
;!!!28.8
        define BYTES4800_32     '22'    ;22 bytes (172.8 bits ==> 176 bits)
        define BYTES4800_48     '15'    ;15 bytes (115.2 bits ==> 120 bits

        define BAUD38400        '5'     ;dip switch code for 38400 baud
        define M_SCCR38400      '$c'    ;set clock for 38400 baud rate
;!!!28.8
        define BYTES38400_16    '384'   ;384 bytes (3072.0 bits ==> 3072 bits)
        define BYTES38400_24    '384'   ;384 bytes (3072.0 bits ==> 3072 bits)
;       define BYTES38400_16    '346'   ;346 bytes (2764.8 bits ==> 2768 bits)
;       define BYTES38400_24    '231'   ;231 bytes (1843.2 bits ==> 1848 bits)
;!!!28.8
        define BYTES38400_32    '173'   ;173 bytes (1382.4 bits ==> 1384 bits)
        define BYTES38400_48    '116'   ;116 bytes (921.6 bits ==> 928 bits)

        define BAUD9600         '6'     ;dip switch code for 9600 baud
        define M_SCCR9600       '$33'   ;set clock for 9600 baud rate
;!!!28.8
        define BYTES9600_16     '96'    ;96 bytes (768.0 bits ==> 768 bits)
        define BYTES9600_24     '96'    ;96 bytes (768.0 bits ==> 768 bits)
;       define BYTES9600_16     '87'    ;87 bytes (691.2 bits ==> 696 bits)
;       define BYTES9600_24     '58'    ;58 bytes (460.8 bits ==> 464 bits)
;!!!28.8
        define BYTES9600_32     '44'    ;44 bytes (345.6 bits ==> 352 bits)
        define BYTES9600_48     '29'    ;29 bytes (230.4 bits ==> 232 bits)

        define BAUD19200        '7'     ;dip switch code for 19200 baud
        define M_SCCR19200      '$19'   ;set clock for 19200 baud rate
;!!!28.8
        define BYTES19200_16    '192'   ;192 bytes (1536.0 bits ==> 1536 bits)
        define BYTES19200_24    '192'   ;192 bytes (1536.0 bits ==> 1536 bits
;       define BYTES19200_16    '173'   ;173 bytes (1382.4 bits ==> 1384 bits)
;       define BYTES19200_24    '116'   ;116 bytes (921.6 bits ==> 928 bits)
;!!!28.8
        define BYTES19200_32    '87'    ;87 bytes (691.2 bits ==> 696 bits)
        define BYTES19200_48    '58'    ;58 bytes (460.8 bits ==> 464 bits)

;define sampling rate table of ISO MUSICAM frame header codes

SAMPLERATES     macro

samplng

;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
;!!!28.8
        dc      SAMPLINGRATE_16         ;old CCS CDQ1000 sampling at 14.4 K
        dc      SAMPLE_ID_BIT_HIGH      ;old CCS CDQ1000 header sampling id bit
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 1 channel
```

```
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 1 channel
        dc      SAMPLINGRATE_16         ;old CCS CDQ1000 sampling at 14.4 K
        dc      SAMPLE_ID_BIT_HIGH      ;old CCS CDQ1000 header sampling id bit
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 1 channel
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 2 channel
        dc      MAXCRITBNDS_16          ;number of critical bands at 14.4 K
        dc      NMSKFREQS_16            ;num freqs used for coding at 14.4 K
        dc      SAMPLINGRATE_16         ;old CCS CDQ1000 sampling at 14.4 K
        dc      SAMPLE_ID_BIT_HIGH      ;old CCS CDQ1000 header sampling id bit
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 1 channel
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 2 channel
        dc      SAMPLINGRATE_16         ;old CCS CDQ1000 sampling at 14.4 K
        dc      SAMPLE_ID_BIT_HIGH      ;old CCS CDQ1000 header sampling id bit
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 1 channel
        dc      MAXSUBBANDS_CCS         ;old CCS CDQ1000 max sub-bands 2 channel
        dc      MAXCRITBNDS_16          ;number of critical bands at 14.4 K
        dc      NMSKFREQS_16            ;num freqs used for coding at 14.4 K
;!!!28.8
;!!!28.8        endif

        endm

;define framing bit rate table

BITRATES        macro

bitrates

;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
;!!!28.8
;entry for code 0       RATE_LO         ;framing bit rate of 28.8 Kbits
        dc      BITRATE_56      ;ISO frame header code for 28.8 Kbits
        dc      BITRATE_56      ;ISO frame header code for 28.8 Kbits
        dc      OUTM56_16       ;num 24 bit wds 28.8 Kbit frame @ 14.4 K sample
        dc      OUTB56_16       ;num bits 28.8 Kbit frame @ 14.4 K sample
        dc      BITRATE_56      ;ISO frame header code for 28.8 Kbits
        dc      BITRATE_56      ;ISO frame header code for 28.8 Kbits
        dc      OUTM56_16       ;num 24 bit wds 28.8 Kbit frame @ 14.4 K sample
        dc      OUTB56_16       ;num bits 28.8 Kbit frame @ 14.4 K sample

;entry for code 1       RATE_HI         ;framing bit rate of 28.8 Kbits
        dc      BITRATE_64      ;ISO frame header code for 28.8 Kbits
        dc      BITRATE_64      ;ISO frame header code for 28.8 Kbits
        dc      OUTM64_16       ;num 24 bit wds 28.8 Kbit frame @ 14.4 K sample
        dc      OUTB64_16       ;num bits 28.8 Kbit frame @ 14.4 K sample
        dc      BITRATE_64      ;ISO frame header code for 28.8 Kbits
        dc      BITRATE_64      ;ISO frame header code for 28.8 Kbits
        dc      OUTM64_16       ;num 24 bit wds 28.8 Kbit frame @ 14.4 K sample
        dc      OUTB64_16       ;num bits 28.8 Kbit frame @ 14.4 K sample
;!!!28.8
;!!!28.8        endif
        endm

;define bit allocation bandwidth tables

BANDWIDTHS      macro

bndwtbl

;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
```

```
;!!!28.8
; KBit rates low/high @ 14400 sampling

        dc      USEDSUBBANDS_00_16  ;  rate low code 00: mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_01_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_10_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_11_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation

        dc      USEDSUBBANDS_00_16  ;  rate high code 01: mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_01_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_10_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_11_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation

; KBit rates low/high @ 14400 sampling

        dc      USEDSUBBANDS_00_16  ;  rate low code 00: mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_01_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_10_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_11_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation

        dc      USEDSUBBANDS_00_16  ;  rate high code 01: mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_01_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_10_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
        dc      USEDSUBBANDS_11_16  ;          mono band-width
        dc      LIMITSUBBANDS       ;      subbands requiring 1 allocation
;!!!28.8
;!!!28.8        endif

        endm

;define ancillary data baud rate table of clock values and byte counts

BAUDCLK         macro

baudclk
;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
;!!!28.8
        dc      M_SCCR300       ;set clock for 300 data baud rate    (0)
        dc      BYTES300_16     ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES300_16     ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR1200      ;set clock for 1200 data baud rate   (1)
        dc      BYTES1200_16    ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES1200_16    ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR2400      ;set clock for 2400 data baud rate   (2)
        dc      BYTES2400_16    ;tol check of bytecnt @ sample 14.4 K
```

```
        dc      BYTES2400_16            ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR3600              ;set clock for 3600 data baud rate   (3
        dc      BYTES3600_16            ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES3600_16            ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR4800              ;set clock for 4800 data baud rate   (4)
        dc      BYTES4800_16            ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES4800_16            ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR38400             ;set clock for 38400 data baud rate  (5)
        dc      BYTES38400_16           ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES38400_16           ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR9600              ;set clock for 9600 data baud rate   (6
        dc      BYTES9600_16            ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES9600_16            ;tol check of bytecnt @ sample 14.4 K
        dc      M_SCCR19200             ;set clock for 19200 data baud rate  (7
        dc      BYTES19200_16           ;tol check of bytecnt @ sample 14.4 K
        dc      BYTES19200_16           ;tol check of bytecnt @ sample 14.4 K
;!!!28.8
;!!!28.8        endif

        endm

;define MICRO decoder Auto Select MUSICAM frame sizes to determine if:
;       input data is MUSICAM frames vs G722 data
;       what is the framing bit rate and sampling rate

AUTOFRAME       macro

autotbl
;!!!28.8        if SAMPLE_RATE_PAIR==SAMPLE_16K_AND_24K
;!!!28.8
        dc      OUTM56_16               ;96 words in 28.8 Kbit frame @ 14.4 KHz
        dc      OUTM64_16               ;96 words in 28.8 Kbit frame @ 14.4 KHz
        dc      OUTM56_16               ;96 words in 28.8 Kbit frame @ 14.4 KHz
        dc      OUTM64_16               ;96 words in 28.8 Kbit frame @ 14.4 KHz
;!!!28.8
;!!!28.8        endif

        endm
;
;
;*******************************
; end of box_ctl.asm
;*******************************
;
        list
```

```
        opt     fc

; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\dcframe.asm: u_psych parameter for findrms vs checksub

        title   'PCM data thru XPSYCHO and XCODE'

; multiple mono channels

; This routine receives a buffer of PCM data and builds a stand alone
;       single channel mono frame for multiple mono channel devices
;
;

; on entry
;       r0 = address of the input PCM buffer
;       r1 = address of the coded frame buffer
;
; on exit
;       a = destroyed
;       b = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'

        section highmisc
        xdef    ntonals
        xdef    nmasker

        org     xhe:
stdcframe_xhe

ntonals ds      1                       ;number of tonals in tonal structure
nmasker ds      1                       ;number of maskers in masker structure

enddoframe_xhe
        endsec

        section ytables
        xdef    rngtbl

        org     yhe:
stdcframe_ytbl

rngtbl                                  ;table for searching for tonals
        dc      2,3,6,6,12,12,12,12

enddoframe_ytbl
        endsec

        org     phe:

dcframe

;!!!dbg
```

```
;       rts     ;jmp    <top                  ;!!! debug if using stored frames buffer
;       jmp     <_xcode_
;       jmp     <_polya_
;!!!dbg

;******************************************************************
;********                     ****************************
;********   Start XPSYCHO     ****************************
;********                     ****************************
;******************************************************************

; Now get the position to read the fft data from
; This buffer is offset from the polyphase filter to account for the
; delay through the filter.

        move    #PCMSIZE-1,m0         ;set to a mod buffer
        move    y:<polyst,r0          ;get input pcm buffer address
        move    #(256-64),n0          ;back up to position fft
        move    #hbuf,r1              ;get hanning output buffer address
        move    (r0)-n0

        jsr     <hanning              ;apply a hanning window
        move    y:<linear,m0          ;restore r0 to linear buffer

        jsr     <fft                  ;fft the data

        move    #fftbuf,r0            ;real part of fft
        move    #fftbuf,r4            ;imaginary part of fft
        move    #power,r1             ;power array
        jsr     <logpow               ;compute power of fft data

        move    #power,r0             ;power array
        move    #SBMaxDb,r1           ;maximum in each sub-band (slb)
        jsr     <findmaxi             ;find max power in a sub-band

        move    #power,r1             ;power array
        move    #Tonals,r2            ;tonal array
        move    #rngtbl,r4            ;range table for tonal search
        jsr     <findtona             ;find tonals
        move    r3,x:ntonals          ;save number of tonals

        move    #power,r1             ;power array
        move    #Tonals,r2            ;tonal array
        move    #rngtbl,r4            ;range table for tonal search
        jsr     <zeropowe             ;zero power around tonals

        move    #power,r1             ;power array
        move    #NoisePwr,r2          ;address of the noise array
        jsr     <findnois             ;find the noise

        move    #Maskers,r3           ;address of the masker structure
        move    #NoisePwr,r2          ;address of the noise array
        move    #Tonals,r1            ;address of the Tonals structure
        move    x:ntonals,x0          ;# of tonals in Tonals structure
        jsr     <mergemas             ;merge the maskers
        move    b,x:nmasker           ;save # of maskers

        move    #Maskers,r0           ;get address of the Masker structure
        move    x:nmasker,b           ;number of maskers in masker structure
        jsr     <finddbma             ;find the db value of maskers
```

```
;       move    #Maskers,r0             ;get address of the Masker structure
;       jsr     <pruneclo               ;prune close maskers

        move    #Maskers,r0             ;get address of the Masker structure
        move    x:nmasker,b             ;number of maskers in masker structure
        jsr     <prunequi               ;prune quiet maskers

        move    #Maskers,r0             ;get address of the Masker structure
        move    x:nmasker,b             ;number of maskers in masker structure
        jsr     <prunemas               ;prune masked maskers

        move    #Tonals,r0              ;address of the Tonals structure
        move    x:ntonals,x0            ;# of tonals in Tonals structure
        move    #Alisng,r1              ;destination buffer address
        jsr     <findalis               ;find alising components
        move    b,x:nalias

        move    #Maskers,r4             ;get address of the Masker structure
        move    #GlbMsk,r1              ;address of global masking threshold
        jsr     <QCalcGlo               ;calculate global masking threshold

_polya_

; polyphase filter the input data

        move    y:<polyst,r0            ;get polyana start address
        move    #PCMSIZE-1,m0           ;set as a mod buffer
        move    #PlAnal,r5              ;set start of the sub-band output buffer
        jsr     <polyanal               ;poly analyze the data
        move    y:<linear,m0            ;restore to linear ctl

; develop the scale factors
;initialize the table of scale factors to minimum amplitude (63 ==> 0 ampl)

        move    #SBndSKF,r0             ;addr of sub-band scale factors
        move    #63,n4

        do      #NUMSUBBANDS*NPERGROUP,_init_00
        move    n4,x:(r0)+              ;get value to store shared memory

_init_00
        move    #PlAnal,r0              ;addr of poly analyzed data
        move    #SBndSKF,r1             ;addr of sub-band scale factors
        jsr     <findskf                ;find scale factors

; develop the SBits for scale factors

        move    #SBndSKF,r0             ;addr of sub-band scale factors
        move    #SBits,r1               ;addr of sub-band sbits
        jsr     <pickskf                ;pick the best scale factors

_xcode_

;*******************************************************
;********            ******************************
;********   Start XCODE   ******************************
;********            ******************************
;*******************************************************
```

```
;determine which method to use to determine the sub-band maximum values

        move    y:u_psych,a             ;get use findrms.asm rtn parameter
        move    #.5,x1                  ;if less than .5, use checksub.asm rtn
        cmp     x1,a                    ;see if parameter less than .5
        jlt     <_do_checksub           ;if less, use checksub.asm rtn

;use RMS for maximum level for the sub-band

        move    #PlAnal,r0              ;addr of poly analyzed data
        move    #SBMaxDb,r1             ;addr of sub-band max
        jsr     <findrms                ;find max in a subband
        jmp     <_set_min_mask          ;go to set minimum masking level

_do_checksub

;set correct maximum level for the channel

        move    #SBndSKF,r0             ;addr of sub-band scale factors
        move    #SBMaxDb,r1             ;addr of sub-band max
        jsr     <checksub               ;find max in a subband

_set_min_mask

;set minimum masking level in each sub-band

        move    #GlbMsk,r0              ;channel global masking threshold
        move    #MinMskDb,r1            ;minimum masking per subband (slb)
        jsr     <findminm               ;find min masking

;set minimum masking level in each sub-band: left channel then right channel

        move    x:nalias,a              ;number of aliaser's
        move    #Alisng,r0              ;aliasing structure
        move    #SBMaxDb,r1             ;max in each sub-band (slb)
        jsr     <findmaxs               ;find the maximum signal

;set number of fixed bits required, and the number of available bits for audio

        jsr     <bitpool

        move    x0,y:fixbits            ;save fixed bit count
        move    x1,y:audbits            ;save bit count available for alloc

;allocate the bits in the frame by subband

        move    #SBits,r0               ;scale factors
        move    #MinMskDb,r1            ;minimum masking per sub-band (slb)
        move    #SBMaxDb,r2             ;maximum in each sub-band (slb)
        move    #SBPos,r4               ;sub-band position
        move    #SBIndx,r5              ;sub-band indicies
        jsr     <bitalloc               ;allocate the bits

;code the channel audio frame

        jsr     <codeframe

        rts
```

```
        opt     fc

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;
;\RMICRO\getbal.asm

        title   'Get bit allocations'

; This routine is used to get the bit allocations of each of the sub-bands.
;
; It is from the ISO standard.
; sub-band  0 - 10 use 4 bits (11 * 4 = 44 bits)
; sub-band 11 - 22 use 3 bits (12 * 3 = 36 bits)
; sub-band 23 - 26 use 2 bits ( 4 * 2 =  8 bits)
;                             ( total = 88 bits)

; on entry
;       r0 = address of bit allocation array for both left and right channels
;
;       r6 = current offset in the input array
;       n6 = base address of the input array
;       y:<maxsubs = MAXSUBBANDS at sampling rate and bit rate
;       y:sc = shift count of current input word
;       y:frmtype = full stereo, joint stereo or mono
;       y:sibound = joint stereo sub-band intensity bound
;       x:crcbits = accumulator of bits covered by CRC-16 routine
;                       (bit allocation bits are accumulated)

; on exit
;       r6 = updated
;       y:sc = updated
;
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r2 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'

;!!!DGCST:
;;      section highmisc
;;      xdef    masktbl
;;      xdef    tbl
;;
;;      org     yhe:
;;stgetbal_yhe
;;
;;masktbl
;;      dc      $000000             ;place holder in mask table
;;      dc      $000001             ;mask table for 1 bit getvalue
;;      dc      $000003             ;mask table for 2 bit getvalue
;;      dc      $000007             ;mask table for 3 bit getvalue
;;      dc      $00000f             ;mask table for 4 bit getvalue
```

```
;;      dc      $00001f                     ;mask table for 5 bit getvalue
;;      dc      $00003f                     ;mask table for 6 bit getvalue
;;      dc      $00007f                     ;mask table for 7 bit getvalue
;;      dc      $0000ff                     ;mask table for 8 bit getvalue
;;      dc      $0001ff                     ;mask table for 9 bit getvalue
;;      dc      $0003ff                     ;mask table for 10 bit getvalue
;;      dc      $0007ff                     ;mask table for 11 bit getvalue
;;      dc      $000fff                     ;mask table for 12 bit getvalue
;;      dc      $001fff                     ;mask table for 13 bit getvalue
;;      dc      $003fff                     ;mask table for 14 bit getvalue
;;      dc      $007fff                     ;mask table for 15 bit getvalue
;;      dc      $00ffff                     ;mask table for 16 bit getvalue
;;
;;;define data size table for the getvalue routine to extract data
;;
;;tbl
;;      dc      $000000                            ;bits =  0, place holder
;;      dc      $000001                            ;shift left 01 bits
;;      dc      $000002                            ;shift left 02 bits
;;      dc      $000004                            ;shift left 03 bits
;;      dc      $000008                            ;shift left 04 bits
;;      dc      $000010                            ;shift left 05 bits
;;      dc      $000020                            ;shift left 06 bits
;;      dc      $000040                            ;shift left 07 bits
;;      dc      $000080                            ;shift left 08 bits
;;      dc      $000100                            ;shift left 09 bits
;;      dc      $000200                            ;shift left 10 bits
;;      dc      $000400                            ;shift left 11 bits
;;      dc      $000800                            ;shift left 12 bits
;;      dc      $001000                            ;shift left 13 bits
;;      dc      $002000                            ;shift left 14 bits
;;      dc      $004000                            ;shift left 15 bits
;;      dc      $008000                            ;shift left 16 bits
;;
;;endgetbal_yhe
;;      endsec

        section highmisc
        xdef    skftbl
        xdef    skftbl_1
        xdef    skftbl_2
        xdef    skftbl_3

        org     xhe:
stgetbal_xhe

;address of BAL's bit table as per Allowed table selected

skftbl  ds      1

;These tables is the number of bits used by the scale factor in each sub-band

; High sampling rates with higher bit rate framing

skftbl_1
        dc      4                   ;sub-band 0
        dc      4                   ;sub-band 1
        dc      4                   ;sub-band 2
        dc      4                   ;sub-band 3
```

```
        dc      4               ;sub-band 4
        dc      4               ;sub-band 5
        dc      4               ;sub-band 6
        dc      4               ;sub-band 7
        dc      4               ;sub-band 8
        dc      4               ;sub-band 9
        dc      4               ;sub-band 10

        dc      3               ;sub-band 11
        dc      3               ;sub-band 12
        dc      3               ;sub-band 13
        dc      3               ;sub-band 14
        dc      3               ;sub-band 15
        dc      3               ;sub-band 16
        dc      3               ;sub-band 17
        dc      3               ;sub-band 18
        dc      3               ;sub-band 19
        dc      3               ;sub-band 20
        dc      3               ;sub-band 21
        dc      3               ;sub-band 22

        dc      2               ;sub-band 23
        dc      2               ;sub-band 24
        dc      2               ;sub-band 25
        dc      2               ;sub-band 26
;end table 3-B.2a
        dc      2               ;sub-band 27
        dc      2               ;sub-band 28
        dc      2               ;sub-band 29
;end table 3-B.2b
        dc      2               ;sub-band 30
        dc      2               ;sub-band 31

; High sampling rates with lower bit rate framing

skftbl_2
        dc      4               ;sub-band 0
        dc      4               ;sub-band 1

        dc      3               ;sub-band 2
        dc      3               ;sub-band 3
        dc      3               ;sub-band 4
        dc      3               ;sub-band 5
        dc      3               ;sub-band 6
        dc      3               ;sub-band 7
;end table 3-B.2c
        dc      3               ;sub-band 8
        dc      3               ;sub-band 9
        dc      3               ;sub-band 10
        dc      3               ;sub-band 11
;end table 3-B.2d
        dc      3               ;sub-band 12
        dc      3               ;sub-band 13
        dc      3               ;sub-band 14
        dc      3               ;sub-band 15
        dc      3               ;sub-band 16
        dc      3               ;sub-band 17
        dc      3               ;sub-band 18
        dc      3               ;sub-band 19
        dc      3               ;sub-band 20
```

```
        dc      3               ;sub-band 21
        dc      3               ;sub-band 22
        dc      3               ;sub-band 23
        dc      3               ;sub-band 24
        dc      3               ;sub-band 25
        dc      3               ;sub-band 26
        dc      3               ;sub-band 27
        dc      3               ;sub-band 28
        dc      3               ;sub-band 29
        dc      3               ;sub-band 30
        dc      3               ;sub-band 31

; Low sampling rates

skftbl_3
        dc      4               ;sub-band 0
        dc      4               ;sub-band 1
        dc      4               ;sub-band 2
        dc      4               ;sub-band 3

        dc      3               ;sub-band 4
        dc      3               ;sub-band 5
        dc      3               ;sub-band 6
        dc      3               ;sub-band 7
        dc      3               ;sub-band 8
        dc      3               ;sub-band 9
        dc      3               ;sub-band 10

        dc      2               ;sub-band 11
        dc      2               ;sub-band 12
        dc      2               ;sub-band 13
        dc      2               ;sub-band 14
        dc      2               ;sub-band 15
        dc      2               ;sub-band 16
        dc      2               ;sub-band 17
        dc      2               ;sub-band 18
        dc      2               ;sub-band 19
        dc      2               ;sub-band 20
        dc      2               ;sub-band 21
        dc      2               ;sub-band 22
        dc      2               ;sub-band 23
        dc      2               ;sub-band 24
        dc      2               ;sub-band 25
        dc      2               ;sub-band 26
        dc      2               ;sub-band 27
        dc      2               ;sub-band 28
        dc      2               ;sub-band 29
;end table 3-B.1
        dc      2               ;sub-band 30
        dc      2               ;sub-band 31

endgetbal_xhe
        endsec

        org     phe:

;initialize:
;  a. r1 with start of subband allocation table of bits in frame per sub-band
;  b. n0 offset for right channel sub-band bit allocation values:
;        left channel from 0 to (NUMSUBBANDS - 1)
```

```
;     right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;  c. r3 set with joint stereo sub-band boundary for stereo intensity:
;        4 (4-31), 8 (8-31), 12 (12-31) or 16 (16-31)
;
getbal
        move    x:skftbl,r1
        move    #masktbl,r2
        move    #NUMSUBBANDS,n0         ;offset for right channel
        move    y:<sibound,r3           ;decr stereo intens sub-band ctr
        move    x:crcbits,r5            ;get CRC-16 bit counter
;
;loop through the sub-bands extracting the left and right (if applicable)
;bit allocation index values (y:<maxsubs = fixed count of sub-bands framed):
; a. for current sub-band get the number of bits for allocation index value
;    and increment address of the next sub-band bit count
; b. get the bit allocation for the left channel always
; c. b register isolate the type of frame: full stereo, joint stereo or mono
; d. y0 holds the mono frame type code for testing
; e. y1 holds the joint stereo frame type code for testing
; f. see if the frame type is joint stereo and just in case, move the
;    current stereo intensity sub-band boundary counter value for testing
; g. if not joint stereo, see if this is a mono frame type
; h. if it is joint stereo:
;     1. test if the boundary counter has reached zero, and just in case it has,
;        restore the left channel bit allocation value to the a1 register
;     2. if the counter is zero, go to copy left channel into the right channel
;     3. if not, go to extract the full stereo right channel allocation value
;
        do      y:<maxsubs,_getb_40
        move    x:(r1)+,n4                      ;get # of bits to read
        move    n4,n2                           ;get hi order bit mask index
        move    n4,n5                           ;to accumulate CRC-16 bits
        jsr     <getvalue                       ;get a left chan bit allocation
        move    y:(r2+n2),x1                    ;mask for high order one's
        move    (r5)+n5                         ;accum bits for CRC-16 rtn
        and     x1,a    y:<frmtype,b            ;mask off high order one's
                                                ; & set for frame type compare
        move    a1,x:(r0)                       ;set left channel
        move    #>MONO,y0                       ;ck for no right channel
        move    #>JOINT_STEREO,y1               ;ck for intensity sub-band
        cmp     y1,b    r3,a                    ;check for stereo intensity
        jne     <_getb_10                       ;if not, see if mono
        tst     a       x:(r0),a1               ;reached bound, restore left val
        jeq     <_getb_30                       ;yes, left val to right val
        move    (r3)-                           ;no, decr intens sub-band cntr
        jmp     <_getb_20                       ; and retreive right chan value
;
;test for a mono type of frame and just in case it is, set a1 to zero
;  for insertion into the right channel for consistency
;if it is mono, go to move the right channel value
; otherwise, fall through to full stereo
;
_getb_10
        cmp     y0,b    #0,a1                   ;if mono, insert 0 for right
        jeq     <_getb_30
;
;full stereo, extract the right channel bit allocation value
;
_getb_20
        jsr     <getvalue                       ;get a right chan bit allocation
```

```
        move    y:(r2+n2),x1                        ;mask for high order one's
        move    (r5)+n5                             ;accum bits for CRC-16 rtn
        and     x1,a                                ;mask off high order one's
;
;insert the right channel value (n0 offset)
;increment for the next sub-band
;
_getb_30
        move    a1,x:(r0+n0)                        ;right channel sub-band alloc
        move    (r0)+                               ;incr for next sub-band

_getb_40
;
; Fill the unused sub-bands with 0 bit allocation
; This allows getdata to process these sub-bands normally and insert 0
; data in them.
;
        clr     a       #>NUMSUBBANDS,b
        move    y:<maxsubs,x0                       ;current MAXSUBBANDS
        sub     x0,b                                ;equals unused sub-bands
        do      b,_getb_50
        move    a,x:(r0+n0)                         ;right channel
        move    a,x:(r0)+                           ;left chan & incr for next

_getb_50
        move    r5,x:crcbits            ;store updated CRC-16 bit counter

        rts
```

```
        opt fc,cex,mex
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\getdata.asm: moves to high P-Memory

        title   'Get the Data'

; This routine sets the data in the output buffer

; on entry
;       r3 = address of left & right channel SubBandIndex array (x memory)
;       r2 = address of left & right channel SubBandSKFs array (x memory)
;       r1 = addr of buffer for a set of left and right channel recovered data:
;            (192 samples: one group of 3 samples, 32 subbands, 2 channels)
;       y:<maxsubs = MAXSUBBANDS at sampling rate and bit rate
;       y:AllwAdd = address of the proper Allowed table at sample/bit rates
;       y:frmtype = whether full stereo, joint stereo or mon frame
;       y:sibound = if joint stereo, sub-band boundary for stereo intensity
;   shared memory for rsynth

; on exit
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r2 = destroyed
;       r3 = destroyed
;       r4 = destroyed
;       r5 = destroyed
;       n0 = destroyed
;       n1 = destroyed
;       n2 = destroyed
;       n3 = destroyed
;       n4 = destroyed
;       n5 = destroyed

        include 'def.asm'
        include '..\rmicro\getvalue.mac'

        section highmisc
        xdef    NBits
        xdef    CC
        xdef    DD
        xdef    packmax
        xdef    packrpl

        org     xhe:
stgetdata_xhe

NBits
        dc      0                               ;position = 0, place holder
        dc      2                               ;position = 1
        dc      3                               ;position = 2
        dc      3                               ;position = 3
        dc      4                               ;position = 4
```

```
        dc      4                               ;position = 5
        dc      5                               ;position = 6
        dc      6                               ;position = 7
        dc      7                               ;position = 8
        dc      8                               ;position = 9
        dc      9                               ;position = 10
        dc      10                              ;position = 11
        dc      11                              ;position = 12
        dc      12                              ;position = 13
        dc      13                              ;position = 14
        dc      14                              ;position = 15
        dc      15                              ;position = 16
        dc      16                              ;position = 17

CC
        dc      0               ;position 0, place holder
        dc      $555555         ; 4.0/(3.0*2.0) position 1 */
        dc      $666666         ; 8.0/(5.0*2.0) position 2 */
        dc      $492492         ; 8.0/(7.0*2.0) position 3 */
        dc      $71C71C         ; 16.0/(9.0*2.0) position 4 */
        dc      $444444         ; 16.0/(15.0*2.0) position 5 */
        dc      $421084         ; 32.0/(31.0*2.0) position 6 */
        dc      $410410         ; 64.0/(63.0*2.0) position 7 */
        dc      $408102         ; 128.0/(127.0*2.0) position 8 */
        dc      $404040         ; 256.0/(255.0*2.0) position 9 */
        dc      $402010         ; 512.0/(511.0*2.0) position 10 */
        dc      $401004         ; 1024.0/(1023.0*2.0) position 11 */
        dc      $400801         ; 2048.0/(2047.0*2.0) position 12 */
        dc      $400400         ; 4096.0/(4095.0*2.0) position 13 */
        dc      $400200         ; 8192.0/(8191.0*2.0) position 14 */
        dc      $400100         ; 16384.0/(16383.0*2.0) position 15 */
        dc      $400080         ; 32768.0/(32767.0*2.0) position 16 */
        dc      $400040         ; 65536.0/(65535.0*2.0) position 17 */

DD
        dc      $000000         ; position 0, place holder
        dc      $c00000         ; position 1, .5000000-1.0 */
        dc      $c00000         ; position 2, .5000000-1.0 */
        dc      $a00000         ; position 3, .2500000-1.0 */
        dc      $c00000         ; position 4, .5000000-1.0 */
        dc      $900000         ; position 5, .1250000-1.0 */
        dc      $880000         ; position 6, .0625000-1.0 */
        dc      $840000         ; position 7, .0312500-1.0 */
        dc      $820000         ; position 8, .0015625-1.0 */
        dc      $810000         ; position 9, .0007812-1.0 */
        dc      $808000         ; position 10, .0003906-1.0 */
        dc      $804000         ; position 11, .0001953-1.0 */
        dc      $802000         ; position 12, .0000976-1.0 */
        dc      $801000         ; position 13, .0000488-1.0 */
        dc      $800800         ; position 14, .0000244-1.0 */
        dc      $800400         ; position 15, .0000122-1.0 */
        dc      $800200         ; position 16, .0000061-1.0 */
        dc      $800100         ; position 17, .0000030-1.0 */

;check for bit errors in packed positions: 1, 2, 3 and 4
;                 STANDARD ISO            CCS COMPRESSED
; position      max   replacement       max   replacement
;              value    value          value    value
;
;    1           26       13             14        7
;    2          124       62             62       31
```

```
;    3          ---      ---         438      219
;    4          728      364         ---      ---

packmax dc      1
packrpl dc      1

endgetdata_xhe
        endsec

        section lowmisc
        xdef    av
        xdef    bv
        xdef    cv
        xdef    bandcnt
        xdef    block
        xdef    svereg
        xdef    dvalue,cvalue

        org     yli:
stgetdata_yli

av      ds      1                       ;A value after uppacking
bv      ds      1                       ;B value after uppacking
cv      ds      1                       ;C value after uppacking
bandcnt ds      1                       ;incr sub-band for stereo intensity
block   ds      1                       ;block no 0:0-3, 1:4-7, 2:8-11
svereg  ds      1                       ;save a register value
dvalue  ds      1                       ;hold current DValue
cvalue  ds      1                       ;hold current CValue

endgetdata_yli
        endsec

        section highmisc
        xdef    ivdata
        xdef    ASMDadd
        xdef    SKFaddr
        xdef    INXaddr
        xdef    AllwAdd
        xdef    Allow
        xdef    getdataN4Save
        xdef    bereich
        xdef    shftbl

        org     yhe:
stgetdata_yhe

ivdata  ds      1                       ;left & right channel recovered data
ASMDadd ds      1                       ;A start addr shared mem for samples
SKFaddr ds      1                       ;starting addr for SKF's
INXaddr ds      1                       ;starting addr for SBIndx's
AllwAdd ds      1                       ;save addr of applicable Allowed table
Allow   ds      1                       ;current address in Allowed for sb
getdataN4Save   ds      1

        include '..\common\bereich.asm'

shftbl
        dc      $000000                         ;bits =  0, place holder
```

```
        dc      $400000                             ;bits =  1, shift left 23 bits
        dc      $200000                             ;bits =  2, shift left 22 bits
        dc      $100000                             ;bits =  3, shift left 21 bits
        dc      $080000                             ;bits =  4, shift left 20 bits
        dc      $040000                             ;bits =  5, shift left 19 bits
        dc      $020000                             ;bits =  6, shift left 18 bits
        dc      $010000                             ;bits =  7, shift left 17 bits
        dc      $008000                             ;bits =  8, shift left 16 bits
        dc      $004000                             ;bits =  9, shift left 15 bits
        dc      $002000                             ;bits = 10, shift left 14 bits
        dc      $001000                             ;bits = 11, shift left 13 bits
        dc      $000800                             ;bits = 12, shift left 12 bits
        dc      $000400                             ;bits = 13, shift left 11 bits
        dc      $000200                             ;bits = 14, shift left 10 bits
        dc      $000100                             ;bits = 15, shift left 09 bits
        dc      $000080                             ;bits = 16, shift left 08 bits

endgetdata_yhe
        endsec

        org     phe:

getdata
        move    r2,y:SKFaddr                        ;save start address
        move    r3,y:INXaddr                        ;save start address
        move    r1,y:ASMDadd                        ;save start addr ivquant values

        move    #0,r0                               ;start group number

;loop through the 12 groups of 3 samples per sub-band per channel
; advancing through 36 samples
; set-up for the group:
;   1. set starting address for inverse quantized values
;   2. reset the starting address of the Allowed sub-band bits
;   3. determine the SKF factor grouping
;   4. set up for joint stereo sub-band intensity boundary checking

        do      #NUMPERSUBBAND,_getd_90

; set up for next group of samples

        move    y:ASMDadd,r1                        ;reset start recover data addr
        move    r1,y:ivdata                         ;init recovered data curr addr
        move    y:INXaddr,r3                        ;reset SBIndx ptr
        move    y:SKFaddr,r2                        ;reset start SKF address
        move    y:AllwAdd,r5                        ;reset address of allowed
        move    r5,y:Allow                          ;and save

;set which block of SKFs (scale factor indices):
;       0 for group of 4 samples 0-3
;       1 for group of 4 samples 4-7
;       2 for group of 4 samples 8-11

        move    r0,x0                               ;curr group to test
        move    #>4,b
        cmp     x0,b      #0,y1                     ;block [0] groups 0 - 3
        jgt     <_getd_06

        move    #>8,b
        cmp     x0,b      #>1,y1                    ;block [1] groups 4 - 7
```

```
        jgt     <_getd_06

        move    #>2,y1                          ;block [2] groups 8 - 11

_getd_06
        move    (r0)+                           ;increment the group number
        move    y1,y:<block                     ;save which block[0, 1 or 2]

;set-up for joint stereo sub-band intensity control

        move    y:<sibound,n0           ;joint stereo intensity sub-band
        move    n0,y:<bandcnt           ;bound sub-band decremented cntr
        bclr    #JOINT_at_SB_BOUND,y:<ctlflgs ;clear reached intensity sub-band

;process this collection of three samples per sub-band per channel

        do      #NUMSUBBANDS,_getd_80

        move    y:ivdata,r1                     ;left channel block 1st
        move    #0,n3                           ;left channel SBIndx values
        bclr    #LEFT_vs_RIGHT,y:<ctlflgs       ;inidcate working on left chan
        move    y:<block,n2                     ;which block of SKFs

;process left channel and then right channel for current sub-band

        do      #NUMCHANNELS,_getd_75

        move    #NUMSUBBANDS,n1                 ;spaced by number of subbands
        move    x:(r3+n3),n5                    ;SubBandIndex[SubBand]
        move    y:Allow,r5                      ;get the address of Allowed[SB]
        move    #DD,r4                          ;address of the D table
        move    x:(r5+n5),n5                    ;get position for the subband
        move    n5,a                            ;save the position

        tst     a           n5,n4               ;check position == 0 AND
                                                ; set position for DValue fetch
        jeq     <_getd_60                       ;not transmitted

        move    #CC,r5                          ;address of the C table
        move    x:(r4+n4),x1                    ;DValue
        move    x:(r5+n5),x0                    ;CValue
        move    x1,y:<dvalue                    ;save DValue
        move    x0,y:<cvalue                    ;save CValue

        move    #NBits,r5                       ;address of NBits array
        move    #>1,y1                          ;to test for packed pos 1 below
        move    x:(r5+n5),n4                    ;nbits

        move    x:(r2+n2),n5                    ;SKFIndex[SubBand][block]
        move    #bereich,r5                     ;SKF table address

;now, if doing the left channel, continue with extracting data
;otherwise, check for joint stereo and the intensity bound of sub-band
;if right channel joint stereo sub-band intensity boundary reached,
;   inverse quantize the saved raw values extracted for the left channel
;otherwise extract the true right channel stereo values for inverse quantizing

        jclr    #LEFT_vs_RIGHT,y:<ctlflgs,_getd_10 ;clear if doing on left chan
        jset    #JOINT_at_SB_BOUND,y:<ctlflgs,_getd_50 ;reached bound, do right
```

```
_getd_10

; a. set up for extracting the data values
; b. test the position for packed types (positions:1, 2, 3 or 4)

        move    #tbl,r4                 ;get shift table address
        move    n4,n0                   ;save nbits
        move    y:<sc,b                 ;get the shift count
        move    y:<curwd,y0             ;get current frame word
        cmp     y1,a    #>2,y1          ;check position == 1
        jeq     <_getd_20               ;handle pos 1 with 3 packed values
        cmp     y1,a    #>4,y1          ;check position == 2
        jeq     <_getd_30               ;handle pos 2 with 3 packed values
        cmp     y1,a    #>3,y1          ;check position == 4
        jeq     <_getd_40               ;handle pos 4 with 3 packed values
        cmp     y1,a                    ;check position == 3, and if not,
        jne     <_getd_12               ;handle all other pos as unpacked

; for position 3:
;   if compressed mode, handle allocation as a packed value
;       otherwise, handle as ISO standard unpacked set of 3 values

        jset    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_35

_getd_12

; not position 1, 2 or 4 so just a regular input of 3 adjacent data values

        move    y:(r4+n4),x0            ;get shift left multiplier per bit cnt

; extract the 1st value and save it in y:<av

        mpy     x0,y0,a n4,x1           ;shift extracted bits into a1 with
                                        ;     newly shifted curwd in a0
                                        ; & save passed numb bits required
        sub     x1,b    a0,y:<curwd     ;see if next word need to complete value
                                        ; & save newly shifted curwd
        move    b,y:<sc                 ;save new shift count

;let's try a macro

        jge     <_getd_16
        getnextword 10,15

_getd_16
        move    a1,y:<av                ;save 1st for inverse quant

; extract the 2nd value and save it in y:<bv

        move    y:<curwd,y0             ;get current frame word
        move    y:(r4+n4),x0            ;get shift left multiplier per bit cnt
        mpy     x0,y0,a n4,x1           ;shift extracted bits into a1 with
                                        ;     newly shifted curwd in a0
                                        ; & save passed numb bits required
        sub     x1,b    a0,y:<curwd     ;see if next word need to complete value
                                        ; & save newly shifted curwd
        move    b,y:<sc                 ;save new shift count

;let's try a macro
```

```
        jge     <_getd_18
        getnextword 20,25

_getd_18
        move    a1,y:<bv                ;save 2nd for inverse quant

; extract the 3rd value and save it in y:<cv

        move    y:<curwd,y0             ;get current frame word
        move    y:(r4+n4),x0            ;get shift left multiplier per bit cnt
        mpy     x0,y0,a n4,x1           ;shift extracted bits into a1 with
                                        ;     newly shifted curwd in a0
                                        ; & save passed numb bits required
        sub     x1,b    a0,y:<curwd     ;see if next word need to complete value
                                        ; & save newly shifted curwd
        move    b,y:<sc                 ;save new shift count
        jslt    <getnextword            ;yes, get rest from next i/p frame word

        move    a1,y:<cv                ;save 3rd for inverse quant
        jmp     <_getd_50               ;go to do inverse quantizing

; Pos 1: Three adjacent data values are packed into 5 bits.
;        Each of the data values are only 2 bits wide.
;
;       packed_value = value0 * 9 + value1 * 3 + value2
;                          or
;       packed_value = 3 * (value0 * 3 + value1) + value2

_getd_20
        move    #>26,x0                 ;ISO maximum packed value
        move    #>13,x1                 ;ISO replacement value
        move    #MASKUPACK3,n4          ;unpack getvalue mask

; if compressed, switch to compressed mask

        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_21
        move    #>14,x0                 ;CCS compression maximum packed value
        move    #>7,x1                  ;CCS compression replacement value
        move    #MASKUPACK3X,n4         ;compressed unpack getvalue mask

_getd_21
        move    n4,y:<av                ;save in y:<avalue for now
        move    #36,n4                  ;unpack initial divisor
        move    n4,y:<bv                ;save in y:<bvalue for now
        move    #9,n4                   ;unpack initial multiplier
        move    n4,y:<cv                ;save in y:<cvalue for now
        move    #12,n4                  ;unpack second divisor
        move    n4,y:<crcstrt           ;save in y:<crcstrt for now
        move    #3,n4                   ;unpack second multiplier
        move    n4,y:<svereg            ;save in y:<svereg for now
        move    #3,n4                   ;unpack loop counter
        move    n4,y:<not_appl          ;save in y:<not_appl for now
        move    #5,n4                   ;change to packed values nbits

; if compressed, switch to compressed nbits

        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_22
        move    #4,n4                   ;change to compress packed values nbits

_getd_22
```

BAD ORIGINAL

```
        jmp     <_getd_45

; Pos 2: Three adjacent data values are packed into 7 bits.
;        Each of the data values are only 3 bits wide.
;
;        packed_value = value0 * 25 + value1 * 5 + value2
;                            or
;        packed_value = 5 * (value0 * 5 + value1) + value2

_getd_30
        move    #>124,x0                ;ISO maximum packed value
        move    #>62,x1                 ;ISO replacement value
        move    #MASKUPACK5,n4          ;unpack getvalue mask

; if compressed, switch to compressed mask

        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_31
        move    #>62,x0                 ;CCS compression maximum packed value
        move    #>31,x1                 ;CCS compression replacement value
        move    #MASKUPACK5X,n4         ;compressed unpack getvalue mask

_getd_31
        move    n4,y:<av                ;save in y:<avalue for now
        move    #200,n4                 ;unpack initial divisor
        move    n4,y:<bv                ;save in y:<bvalue for now
        move    #25,n4                  ;unpack initial multiplier
        move    n4,y:<cv                ;save in y:<cvalue for now
        move    #40,n4                  ;unpack second divisor
        move    n4,y:<crcstrt           ;save in y:<crcstrt for now
        move    #5,n4                   ;unpack second multiplier
        move    n4,y:<svereg            ;save in y:<svereg for now
        move    #4,n4                   ;unpack loop counter
        move    n4,y:<not_appl          ;save in y:<not_appl for now
        move    #7,n4                   ;change to packed values nbits

; if compressed, switch to compressed nbits

        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_32
        move    #6,n4                   ;change to compress packed values nbits

_getd_32
        jmp     <_getd_45

; Compressed pos 3:
;       Three adjacent data values are packed into 8 bits.
;       Each of the data values are only 3 bits wide.
;
;       packed_value = value0 * 64 + value1 * 8 + value2
;                           or
;       packed_value = 8 * (value0 * 8 + value1) + value2

_getd_35
        move    #>438,x0                ;CCS compression maximum packed value
        move    #>219,x1                ;CCS compression replacement value
        move    #MASKUPACK8X,n4         ;unpack getvalue mask
        move    n4,y:<av                ;save in y:<avalue for now
        move    #200,n4                 ;unpack initial divisor
        move    n4,y:<bv                ;save in y:<bvalue for now
        move    #25,n4                  ;unpack initial multiplier
        move    n4,y:<cv                ;save in y:<cvalue for now
```

```
        move    #40,n4                  ;unpack second divisor
        move    n4,y:<crcstrt           ;save in y:<crcstrt for now
        move    #5,n4                   ;unpack second multiplier
        move    n4,y:<svereg            ;save in y:<svereg for now
        move    #4,n4                   ;unpack loop counter
        move    n4,y:<not_appl          ;save in y:<not_appl for now
        move    #8,n4                   ;change to packed values nbits
        jmp     <_getd_45

; Pos 4: Three adjacent data values are packed into 10 bits.
;        Each of the data values are only 4 bits wide.
;
;       packed_value = value0 * 81 + value1 * 9 + value2
;                           or
;       packed_value = 9 * (value0 * 9 + value1) + value2

_getd_40
        move    #>728,x0                ;ISO maximum packed value
        move    #>364,x1                ;ISO replacement value
        move    #MASKUPACK9,n4          ;unpack getvalue mask
        move    n4,y:<av                ;save in y:<avalue for now
        move    #1296,n4                ;unpack initial divisor
        move    n4,y:<bv                ;save in y:<bvalue for now
        move    #81,n4                  ;unpack initial multiplier
        move    n4,y:<cv                ;save in y:<cvalue for now
        move    #144,n4                 ;unpack second divisor
        move    n4,y:<crcstrt           ;save in y:<crcstrt for now
        move    #9,n4                   ;unpack second multiplier
        move    n4,y:<svereg            ;save in y:<svereg for now
        move    #5,n4                   ;unpack loop counter
        move    n4,y:<not_appl          ;save in y:<not_appl for now
        move    #10,n4                  ;change to packed values nbits
        nop

;handle the data value extraction from the frame and unpack for
;either position 1, 2, 3 (if compressed) or 4

_getd_45
        move    x0,x:packmax            ;save position max packed value
        move    x1,x:packrpl            ;save position replacement value
        move    y:(r4+n4),x0            ;get shift left multiplier per bit cnt

        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_46
        move    n4,y:getdataN4Save      ;save the bit field size

_getd_46
        mpy     x0,y0,a n4,x1           ;shift extracted bits into a1 with
                                        ;     newly shifted curwd in a0
                                        ; & save passed numb bits required
        sub     x1,b    a0,y:<curwd     ;see if next word need to complete value
                                        ; & save newly shifted curwd
        move    b,y:<sc                 ;save new shift count
        jslt    <getnextword            ;yes, get rest from next i/p frame word

        move    y:<av,x1                ;unpack getvalue mask
        and     x1,a                    ;mask off high order one's
        move    a1,a                    ;clean up

;test for a possible bit error that might have caused a value above the
;maximum packed value
```


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```
;if above maximum, replace with the middle value

        move    x:packmax,x1              ;get poisition max packed dvalue
        cmp     x1,a                      ;compare retrieved value to max
        jle     <_getd_47                 ;if not above max value, continue
        move    x:packrpl,a               ;since above, replace value

_getd_47
        jclr    #DECOMPRESS_PACKED,y:<ctlflgs,_getd_48
        move    y:getdataN4Save,r4        ;restore the bit field size
        move    a,n4                      ;set compressed value for table look up
        jsr     <dcompval                 ;get the decompressed value for unpack

_getd_48
        jsr     <unpack                   ;get 3 parts
        move    n0,n4                     ;restore nbits

;now let's inverse quantize the 3 samples

_getd_50
        move    #shftbl,r4                          ;to left justify in ivquanti
        move    y:<av,y0                            ;save A value
        move    y:(r4+n4),y1                        ;get left shift value
        tfr     y1,b                                ;save left shift in b1
        move    y:(r5+n5),b0                        ;get C factor

;ivquanti 1st value:

        mpy     y0,y1,a         y:<dvalue,x1        ;1st value: left justify bits
                                                    ; & set DValue
        move    a0,a                                ;move rslt to correct register
        add     x1,a            y:<cvalue,x0        ;Y + D
                                                    ; & set CValue
                                                    ;forget sign extension
        move    a1,y0                               ;C * (Y + D)
        mpy     x0,y0,a         b0,y0               ; & set up C factor

        move    a,y1                                ;rnd scale factor * C * (Y + D)
        mpyr    y0,y1,a         b1,y1               ; & reget left shift value

        asl     a               y:<bv,y0            ;mult by 2 again
                                                    ; & get B value

;ivquanti 2nd value:

        mpy     y0,y1,a         a,x:(r1)+n1         ;2nd value: left justify bits
                                                    ; & store 1st data value
        move    a0,a                                ;move rslt to correct register
        add     x1,a                                ;Y + D
        move    a1,y0                               ;forget sign extension
        mpy     x0,y0,a         b0,y0               ;C * (Y + D)
                                                    ; & reget C factor

        move    a,y1                                ;rnd scale factor * C * (Y + D)
        mpyr    y0,y1,a         b1,y1               ; & reget left shift value

        asl     a               y:<cv,y0            ;mult by 2 again
                                                    ; & get C value

;ivquanti 3rd value:

        mpy     y0,y1,a         a,x:(r1)+n1         ;3rd value: left justify bits
```

```
                                                  ; & store 2nd data value
        move    a0,a                              ;move rslt to correct register
        add     x1,a                              ;Y + D
        move    a1,y0                             ;forget sign extension
        mpy     x0,y0,a         b0,y0             ;C * (Y + D)
                                                  ; & reget C factor

        move    a,y1                              ;rnd scale factor * C * (Y + D)
        mpyr    y0,y1,a         #>1,y1            ; & setup for intensity bounda
                                                  ;mult by 2 again, & set up
        asl     a       y:<bandcnt,b              ; to test for intensity bounda
                                                  ;store 3rd data value
        move    a,x:(r1)+n1                       ;try next channel
        jmp     <_getd_70

; All the 3 adjacent values in the sub-band are 0

_getd_60
        clr     a       y:<bandcnt,b              ;output 0 value, & setup
                                                  ; to test for intensity bounda
                                                  ;setup for intensity boundary
        move    #>1,y1
        rep     #NPERGROUP
        move    a,x:(r1)+n1

; We have just finished the current channel
;  and if we just did the left, set up for the right channel
; if just did right channel, check for joint stereo and the
;    intensity bound of sub-band
; if not a joint stereo frame, go set-up for the next sub-band.
; if right channel joint stereo sub-band intensity boundary reached,
;    go set-up for the next sub-band.
;otherwise, decrement the intensity boundary sub-band counter
;    before the go set-up for the next sub-band.

_getd_70
        jclr    #LEFT_vs_RIGHT,y:<ctlflgs,_getd_72 ;if did left, go set-up right
        jclr    #JOINT_FRAMING,y:<ctlflgs,_getd_72 ;continue if not joint
        jset    #JOINT_at_SB_BOUND,y:<ctlflgs,_getd_72 ;if reached, continue
        sub     y1,b                              ;not reached so decrement ctr
        move    b1,y:bandcnt                      ;and save for next sub-band
        jgt     <_getd_72                         ;if not reached, continue
        bset    #JOINT_at_SB_BOUND,y:<ctlflgs     ;if reached, set indicator

;after the left channel, set-up to do the right channel

_getd_72
        move    #NUMSUBBANDS*NPERGROUP,n1         ;adj to right channel fields
        move    y:ivdata,r1                       ;get current start address
        move    #>NUMSUBBANDS*NPERGROUP,a         ;move to SKFs for right channel
        move    y:<block,x0                       ;get current block offset
        add     x0,a    #NUMSUBBANDS,n3           ;add right chan offset, set
                                                  ; AND set adj to right SBIndx
        bset    #LEFT_vs_RIGHT,y:<ctlflgs         ;indicate now doint right
        move    (r1)+n1                           ;adjust r1 to right rec data
        move    a1,n2                             ;offset register 2

; We have just finished both channels for a sub-band.
;  1. adjust left and right received sample pointers to next sub-band
;  2. adjust left and right received sample pointer for next sub-band
;  2. increment SBIndx array pointer for next sub-band
;  3. increment the SKFs array pointer over previous sub-band's 2nd & 3rd SKFs
;  4. increment the Allowed array pointer to next sub-band
```

```
_getd_75
        move    #>1,x0                    ;incr left and right rcv'd samps
        move    y:ivdata,a                ;address prev sub-band
        add     x0,a    (r3)+             ;adj next sub-band, incr SBIndx
        move    a,y:ivdata                ;save new addr next sub-band
        move    #>16,x0                   ;adj Allow ptr to next sub-band
        move    y:Allow,a                 ;get current Allow address
        add     x0,a    #3,n2             ;adj Allow ptr, adj SKFs by 3
        move    a,y:Allow                 ;save Allowed for next sub-band
        move    (r2)+n2                   ;next sub-band SKFs addr

_getd_80

;We have just finished a group of 3 samples per sub-band per channel
;  and we must send these value to the polysynthesis dsp

        move    r0,y:<svereg              ;save the key register
        bclr    #0,y:<not_appl            ;clear tested bit if not applic
        jsr     <synth                    ;synth this group of values
        move    y:<svereg,r0              ;restore the key register

_getd_90
        bclr    #0,y:<not_appl            ;clear tested bit if not applic
        rts
```

```
        opt     fc,mex
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\rsdec16.asm: decoder Reed Solomon decoder

        title   'RS Codec 64714 decoding program'
        include 'box_ctl.asm'
        include '..\common\ioequ.asm'
        include 'rstest.asm'

;
; this program will decode data in the input buffer according
; a decode profile with format as follow:
;
;       parity byte, message byte, repetition times -- first block
;       parity byte, message byte, repetition times -- 2nd block
;       ...
;       parity byte, message byte, repetition times,0    -- last block
;
; the output data will be placed at output buffer
;

        section highmisc
        xdef    pbyte
        xdef    mbyte
        xdef    cbyte
        xdef    dbyte
        xdef    inbyte
        xdef    mapbyte
        xdef    RsR3Tmp
        xdef    RsLpCnt
        xdef    RsLpCnt1

        org     yhe:
strdec16_1_yhe
pbyte           ds      1                       ;parity byte
mbyte           ds      1                       ;message byte
cbyte           ds      1                       ;codeword byte
dbyte           ds      1                       ;delay byte
inbyte          ds      1                       ;insert zero byte
mapbyte         ds      1                       ;mess + pari byte
RsR3Tmp         ds      1                       ;tmp store r3
RsLpCnt         ds      1                       ;Rs Loop replacement
RsLpCnt1        ds      1                       ;Rs Loop replacement
endrdec16_1_yhe
        endsec

        section highmisc
        xdef    PROF1
        xdef    CodeMinLen

; formula that cal the legency delay
; (P)parity, (M)message, delay, repetition
; delay = (16*(P+M) + P*P + 4*P +73) / 8 + 1

        org     yhe:
strdec16_2_yhe
PROF1                                   ;RS profile
        dc      16,129,1                ;RS decode
```

```
        dc      14,129,1
        dc      0,0,0
        dc      0,0,0,0

CodeMinLen                                          ;RS code min length per block
        dc      1,6,6,8,10,14,18,24,30,38,46        ;t=0,1,2,..,10
        dc      56,66,78,90,104,118                 ;t=11,12,..,16
endrdec16_2_yhe

        endsec

;***********************************
; RS decode routine
;***********************************

; This code is for RS decoder chip that the input is always enabled
; but output will be enabled when we have the output coming

; on entry
;       r1      :       output ptr in X SPACE
;       r3      :       input profile ptr in Y SPACE
;       r6      :       input data ptr in X SPACE
;
; on exit
;       r1      :       destroyed
;       r2      :       destroyed
;       r3      :       destroyed
;       r4      :       destroyed
;       r5      :       destroyed
;       r6      :       destroyed
;
;       a       :       destroyed
;       b       :       destroyed
;       x0      :       destroyed
;       x1      :       destroyed
;       y0      :       destroyed
;       y1      :       destroyed
;

        org     pli:

rsdec16

;initial here

        move    #-1,m6                  ;reset reg r6 to linear
        move    #0,n6                   ;reset n6 to 0
        move    #-1,m1
        move    #3-1,m2                 ;mod 3 -- 2,1,0
        move    #-1,m5
        move    #2,r2                   ;set to first byte
        move    #0,r5                   ;word count

        move    #>24,x0
        move    x0,y:rssc
        move    x:(r6)+,x0              ;set for rsgetvalues
        move    x0,y:rscurwd

_Bentry
        bclr    #1,x:<<M_PCD            ;turn on the bit clk
```

```
        movep   #S0808,x:<<M_BCR              ;set low to "cs" chip slect
                                              ;set y: for 8 wait state
;SOFTWARE RESET

        clr     a                             ;zero
        move    a1,y:RSReg8                   ;reset in case

; wait for some clock to pass away for the completeness of reset

        do      #400,_resetch
        nop
_resetch

; read message length and parity length from profile

        clr     a         y:(r3)+,x1          ;parity
        move    a,y:inbyte                    ;set no insert byte
        move    x1,y:pbyte
        move    y:(r3)+,a1
        move    a1,y:mbyte                    ;message length

;decide whether add zero is needed

        move    y:pbyte,a1                    ;get parity byte
        lsr     a                             ;/2
        move    #CodeMinLen,r4                ;get min codelen
        move    a,n4                          ;get T
        move    y:mbyte,x1                    ;get message byte len
        move    y:(r4+n4),a                   ;get min len allowed
        cmp     x1,a
        jle     <_NoInsert
        sub     x1,a
        move    a,y:inbyte                    ;store insert byte num
_NoInsert

        move    y:inbyte,a                    ;get inserted byte
        move    y:mbyte,x1
        add     x1,a      y:pbyte,x1          ;codewordleght=mbyte+pbyte+inbyte
        add     x1,a                          ;codewordleght=mbyte+pbyte+inbyte

; wr RS block length

        move    a1,y:RSReg1                   ;a4=0,a3=1 only 40MHZ clk and CS and WR
        move    a1,y:mapbyte                  ;save message + parity byte

        move    y:mbyte,a                     ;get meaasge byte
        move    #>1,x1
        sub     x1,a      y:mbyte,x1          ;get message byte
        move    a1,y:cbyte                    ;save message byte length -1

; cal the delay

        move    y:pbyte,x0                    ;load x0
        mpy     x0,x0,a                       ;p*p
        move    a0,a1
        lsr     a         #>73,x1             ;a == p**2
        add     x0,a      y:pbyte,b           ;+ 73
        lsl     b         a1,x0
        lsl     b         y:mapbyte,a1
        add     x1,b                          ;+ 4xp
```

```
        lsl     a                               ;x 16
        lsl     a
        lsl     a
        lsl     a       b1,x0
        add     x0,a    #>1,x0                  ;+ 16x(m+p)
        lsr     a                               ;/8
        lsr     a
        lsr     a

; cal the delay

        sub     x1,a    y:pbyte,x1              ;get p byte
        sub     x1,a    y:inbyte,x1             ;get insert byte
        sub     x1,a
        move    a1,y:dbyte                      ;delay without output reading

        move    y:pbyte,a1                      ;# of bytes to be PARITY BYTES

; Wr parity length

        move    a1,y:RSReg2                     ;a4=0,a3=1 clk CS/WR pulses are active
        lsr     a                               ;/2 get correction power

; Wr correction power, t number

        move    a1,y:RSReg3                     ;a4=0,a3=1 only reset pulse and clk

        move    #>32,a1                         ;set SYMBOL Synthesis of the RS codec

; Wr synthesis clock

        move    a1,y:RSReg6                     ;N at address 5
        move    #>0,a1                          ;set SYMBOL division 8 bit per symbol

; Wr bit per symbol

        move    a1,y:RSReg7                     ;address 6

; reset again after all register have been filled

        move    #0,a1
        move    a1,y:RSReg8                     ; reset again

; wait for some time

        do      #400,_resetch2
        nop
_resetch2                                       ;40 MHZ clk is there

        bset    #1,x:<<M_PCD                    ;turn off the bit clk after reset

; Initialization is completed

        movep   #$0101,x:<<M_BCR                ;set low duration of "cs"(chip slect ;

; RS decoding start

        move    y:(r3)+,x0                      ;load the repetition time
        move    x0,y:RsLpCnt
        move    r3,y:RsR3Tmp                    ;save r3 for later
```

```
_RsLoop

; get first input byte

        move    #8,n4
        jsr     <rsgetvalues

; or FRAME START SIGNAL and first byte

        move    #>$100,x1                  ;insert frame start signal
        or      x1,a                       ;The first DATA byte is "OR ' gated
                                           ;as the R-S codec thinks you are
                                           ;sending the first data byte at
                                           ;the same time with the FRAME
                                           ;start pulse.
        do      #8,_dtasnd100
        movep   a1,y:<<RSIN                ;SEND 1st data byte and also RAISE the
                                           ; FRAME START PULSE
_dtasnd100

; input message-1 byte to decode

        clr     a        y:cbyte,x0
        move    x0,y:RsLpCnt1              ;initial loop count

_RsLoop1
        move    #8,n4
        jsr     <rsgetvalues
        do      #8,_dtasnd1
        movep   a1,y:<<RSIN                ;a4=1,a3=1 only clk and data
_dtasnd1
        move    y:RsLpCnt1,a               ;test loop cnt
        move    #>1,x0                     ;dec count
        sub     x0,a
        jle     <_EndRsLoop1
        move    a,y:RsLpCnt1               ;resave loop count
        jmp     <_RsLoop1

_EndRsLoop1

; insert zero message byte to decode if it's not zero

        move    y:inbyte,a                 ;chk if insertion is needed
        tst     a
        jeq     <_NoIntion

        clr     a        y:inbyte,x0
        move    x0,y:RsLpCnt1              ;initial loop count

_RsLoop2
        do      #8,_dtasnd3
        movep   a1,y:<<RSIN        ;a4=1,a3=1 only clk and data
_dtasnd3
        move    y:RsLpCnt1,a               ;test loop cnt
        move    #>1,x0                     ;dec count
        sub     x0,a
        jle     <_EndRsLoop2
        move    a,y:RsLpCnt1               ;resave loop count
        clr     a
        jmp     <_RsLoop2
```

```
_EndRsLoop2

_NoIntion

; input parity byte to decode

        clr     a         y:pbyte,x0
        move    x0,y:RsLpCnt1              ;initial loop count

_RsLoop3
        move    #8,n4
        jsr     <rsgetvalues
        do      #8,_dtasnd5
        movep   a1,y:<<RSIN     ;a4=1,a3=1 only clk and data
_dtasnd5
        move    y:RsLpCnt1,a               ;test loop cnt
        move    #>1,x0                     ;dec count
        sub     x0,a
        jle     <_EndRsLoop3
        move    a,y:RsLpCnt1               ;resave loop count
        jmp     <_RsLoop3
_EndRsLoop3

; push zero input for delay byte

        clr     a         y:dbyte,x1
        move    x1,y:RsLpCnt1              ;initial loop count

_RsLoop4
        do      #8,_Gdata100
        movep   a1,y:<<RSIN                ;a4=1,a3=1 only clk and data
_Gdata100
        move    y:RsLpCnt1,a               ;test loop cnt
        move    #>1,x0                     ;dec count
        sub     x0,a
        jle     <_EndRsLoop4
        move    a,y:RsLpCnt1               ;resave loop count
        clr     a
        jmp     <_RsLoop4
_EndRsLoop4

; reading decoded data output

        move    y:mbyte,x1
        move    #>$80,y0                   ;shift right 16 bits
        move    #>$8000,y1                 ;shift right 8 bits

        move    x1,y:RsLpCnt1              ;initial lp count

_RsLoop5
        clr     a         #>$ff,x0
        do      #8,_Gdata200
        movep   a1,y:<<RSIN                ;a4=1,a3=1 only clk and data
_Gdata200
        move    y:RSOUT,b1                 ;provide clock and read data
        and     x0,b
        move    b1,x0                      ;get set for shift

; test byte counter and put output byte to right pos of output buffer
```

```
        move    r2,a                        ;get byte count
        move    #>2,x1
        cmp     x1,a    #>1,x1
        jne     <_Tndbyte

; fst byte

        mpy     x0,y1,a #>$ff0000,x0        ;shift right 8 bits
        clr     b
        move    a0,b1
        and     x0,b
        move    b1,x:(r1)
        jmp     <_EndAByte

_Tndbyte
        cmp     x1,a    #0,x1
        jne     <_Lstbyte

        mpy     x0,y0,a #>$ff00,x0          ;shift right 16 bits
        clr     b
        move    a0,b1
        and     x0,b    x:(r1),x1
        or      x1,b                        ;or it with previous 8 bits
        move    b1,x:(r1)
        jmp     <_EndAByte

_Lstbyte
        clr     b
        move    #>$ff,b1                    ;mask off last 8 bits
        and     x0,b    x:(r1),x1
        or      x1,b    (r5)+               ;increase word count
        move    b1,x:(r1)+                  ;save the musicam data for desort

_EndAByte
        move    (r2)-                       ;2-1-0 mod
        move    y:RsLpCnt1,a                ;test loop cnt
        move    #>1,x0                      ;dec count
        sub     x0,a
        jle     <_EndRsLoop5
        move    a,y:RsLpCnt1                ;resave loop count
        jmp     <_RsLoop5
_EndRsLoop5

; forget inserted zero message byte next

        move    y:inbyte,a                  ;chk if insertion is needed
        tst     a
        jeq     <_NoIntion10

        clr     a       y:inbyte,x0
        move    x0,y:RsLpCnt1               ;initial lp count

_RsLoop6
        do      #8,_dtasnd20
        movep   a1,y:<<RSIN         ;a4=1,a3=1 only clk and data
_dtasnd20
        move    y:RsLpCnt1,a                ;test loop cnt
        move    #>1,x0                      ;dec count
        sub     x0,a
        jle     <_EndRsLoop6
```

```
        move    a,y:RsLpCnt1            ;resave loop count
        clr     a
        jmp     <_RsLoop6
_EndRsLoop6

_NoIntion10

; forget parity output at the end of frame

        clr     a         y:pbyte,x1
        move    x1,y:RsLpCnt1           ;initial lp count

_RsLoop7
        do      #8,_Gdata300
        movep   a1,y:<<RSIN             ;a4=1,a3=1 only clk and data
_Gdata300
        move    y:RsLpCnt1,a            ;test loop cnt
        move    #>1,x0                  ;dec count
        sub     x0,a
        jle     <_EndRsLoop7
        move    a,y:RsLpCnt1            ;resave loop count
        clr     a
        jmp     <_RsLoop7
_EndRsLoop7

        move    y:RsLpCnt,a             ;test loop cnt
        move    #>1,x1                  ;dec count
        sub     x1,a
        jle     <_RepEnd
        move    a,y:RsLpCnt             ;resave loop count
        jmp     <_RsLoop

; repetition end

_RepEnd
        move    y:RsR3Tmp,r3            ;reload profile ptr
        nop
        move    y:(r3),a                ;test if a '0' at last RS block
        tst     a
        jne     <_Bentry

; patch zero to make 96 (a full frame)

        move    #>96,a
        move    r5,x0
        sub     x0,a     #0,x0
        jle     <_PatchZero1
        do      a,_PatchZero1
        move    x0,x:(r1)+              ;inc to next frame
_PatchZero1

; end of RS decoding for One Profile

        move    #-1,m2
        movep   #$0001,x:<<M_BCR        ;set all external io wait states

        rts
```

```
	opt	fc
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\bitalloc.asm: use the o_psych parameter (safety margin)

; This routine is used to allocate the bits.
; It allocates at least some bits to all sub-bands with a positive SMR.
; It allocates in three phases:
;	A. allocate all sub-bands until they are all below
;		the Global Masking Threshold (regardless as to how many
;		bits it takes)
;	   note 1. a limit (sub-band boundary) is set which requires
;		all sub-bands up to the boundary require at least
;		index 1 be allocated even if the signal is already
;		below the Global Masking Threshold. (This provides
;		a noticeable improvement in continuity of sound)
;	After Phase A is completed, a test is made to see if the bit pool
;		was overflowed by the allocation.
;	a. if the frame fits, Phase B is skipped and Phase C is done
;	b. otherwise, Phase B is required to selectively de-allocate the
;		best sub-band candidates.

; on entry
;	y:<stereo = flags:
;    (set on entry) bit 0 indicates whether or not left channel active
;				0 = channel not active
;				1 = channel active for framing
;		bit 1 indicates whether or not center channel active
;				0 = channel not active
;				1 = channel active for framing
;		bit 2 indicates whether or not right channel active
;				0 = channel not active
;				1 = channel active for framing
;		bit 3 is used to indicate left vs right channel
;		    applies if bit 4 set to 0 (NOT center channel)
;				0 = looping through left channel arrays
;				1 = looping through right channel arrays
;		bit 4 is used to indicate center channel vs left right
;				0 = process left or right channel arrays
;				1 = looping through center channel arrays
;		bit 5 is used as the FirstTime switch in an allocation
;				0 = cleared if any allocations were made
;				1 = no allocations made to any sub-bands
;		bit 6 is used for critical de-allocate and allocate passes:
;				with below masking threshold being a criteria
;		    de-allocate:
;				0 = select from any sub-band channel
;				1 = select from only those below mask
;		    allocate:
;				0 = there are sub-band channels not below mask
;				1 = all sub-bands are below mask
;		bit 7 is used for critical de-allocate and allocate passes:
;		    de-allocate:
;				0 = select from any sub-band channel
;				1 = select from those with 2 or more allocation
;		    allocate:
;				0 = are sub-bands not below hearing thresh
;				1 = all sub-bands are below hearing thresh
;		bit 8 is used for critical de-allocate and allocate passes:
```

```
;                   de-allocate:
;                           0 = select from any sub-band channel
;                           1 = select from any sub-band channel
;                   allocate: for final pass after bit allocation timer
;                           0 = timer interrupt not yet sensed
;                           1 = timer interrupt was sensed
;               bit 9 is to simply indicate that the sub-band limit for
;                   allocating at least ONE position has been reached
;                   within a current loop:
;                           0 = NOT at sub-band limit
;                           1 = reached the sub-band limit
;               bit 10 is to simply indicate that the maximum sub-band for
;                   consideration for allocation has been reached
;                   within a current loop:
;                           0 = NOT at maximum sub-band limit
;                           1 = reached the maximum sub-band limit
;
;       y:audbits = number of bits available for sbits, scale factors and data
;       y:<usedsb  = number of sub-bands actually used
;       y:<limitsb  = number of sub-bands requiring at least one allocation
;       y:<qtalloc = timer interrupt set to signal quit allocation loops
;       r0 = addr of the SBits array (x memory)
;       r1 = addr of MinMasking Db array (x memory)
;       r2 = addr of SubBandMax array (x memory)
;       r4 = addr of the SubBandPosition array (x memory)
;       r5 = addr of the SubBandIndex array (x memory)
;
; on exit
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r3 = destroyed
;       r6 = destroyed
;       n0 = destroyed
;       n1 = destroyed
;       n2 = destroyed
;       n3 = destroyed
;       n4 = destroyed
;       n5 = destroyed
;       n6 = destroyed
;
;   AtLimit array by sub-bands (32):
;           bit 0 set when allocation is below the masking threshold
;           bit 1 set when allocation is below the threshold of hearing
;           bit 2 set when allocation is at the limit of maximum position
;                   or there are not enough bits to allocate
;                   the sub-band further

        include 'def.asm'
        include 'box_ctl.asm'

        section lowmisc

        xdef    MNRsub
        xdef    AvlBits
        xdef    TotBits
        xdef    HldBits
```

```
        xdef    count

        org     yli:
stbitalloc_yli

MNRsub  ds      1                       ;count of entries in de-allocate tables
AvlBits ds      1                       ;available bits to allocate
TotBits ds      1                       ;current bit count allocated
HldBits ds      1                       ;sub-band critical allocation
count   ds      1                       ;sub-band counter

endbitalloc_yli
        endsec

        section highmisc

        xdef    BitsAdd
        xdef    BPosAdd
        xdef    BInxAdd
        xdef    AllwAdd
        xdef    MaxPos
        xdef    MNRsb
        xdef    MNRmin
        xdef    MNRinx
        xdef    MNRpos

        org     yhe:
stbitalloc_yhe

BitsAdd ds      1                       ;save address of SBits array
BPosAdd ds      1                       ;save address of SBPosition array
BInxAdd ds      1                       ;save address of SBIndex array
AllwAdd ds      1                       ;save addr of applicable Allowed table
MaxPos  ds      1                       ;Max Position per selected Allowed table
MNRsb   ds      1                       ;curr sub-band for allocation
MNRmin  ds      1                       ;value of curr sub-band for allocation
MNRinx  ds      1                       ;new index for selected sub-band
MNRpos  ds      1                       ;new allowed position for selected sb

endbitalloc_yhe
        endsec

        section highmisc

        xdef    AtLimit
        xdef    SBMsr
        xdef    SBMNRmax
        xdef    MNRval
        xdef    MNRsbc

        org     xhe:
stbitalloc_xhe

;flags set when a sub-band reaches its limit of allocation:
;   (one per 32 subbands)
;       bit 0: set if below the global masking threshold
;       bit 1: set if not used or fully allocated

AtLimit ds      NUMSUBBANDS
```

```
;This array holds the MinMaskingDb - SubBandMax for each of the 32 subbands

SBMsr           ds      NUMSUBBANDS     ;Mask-Signal ratio by sub-band

;This array holds the deallocation selection values:
;       (MinMaskingDb - SubBandMax) + SNR[position at next lower index]
;for each of the 0-31 subbands

SBMNRmax        ds      NUMSUBBANDS     ;Mask-to-Signal ratio
                                        ; plus SNR[PrevPos]

MNRval          ds      NUMSUBBANDS     ;table of ordered values sub-band
MNRsbc          ds      NUMSUBBANDS     ;table of associated sub-band

endbitalloc_xhe
        endsec

        section xtables

        xdef    ndatabit
        xdef    NDataBit
        xdef    NSKFBits
        xdef    SNR

        org     xhe:
stbitalloc_xtbl

;This is the addr of the selected table, ISO or CCS compression,
;    for the number of bits for data allocation by position

ndatabit        ds      1               ;addr ISO or CCS compress NDataBit tbl

;This is the ISO table for the number of bits for data allocation by position

NDataBit
        dc      0*NUMPERSUBBAND         ;index = 0, no transmit = 0   bits
        dc      5*NUMPERSUBBAND         ;index = 1, packed      = 60  bits
        dc      7*NUMPERSUBBAND         ;index = 2, packed      = 84  bits
        dc      9*NUMPERSUBBAND         ;index = 3              = 108 bits
        dc      10*NUMPERSUBBAND        ;index = 4, packed      = 120 bits
        dc      12*NUMPERSUBBAND        ;index = 5              = 144 bits
        dc      15*NUMPERSUBBAND        ;index = 6              = 180 bits
        dc      18*NUMPERSUBBAND        ;index = 7              = 216 bits
        dc      21*NUMPERSUBBAND        ;index = 8              = 252 bits
        dc      24*NUMPERSUBBAND        ;index = 9              = 288 bits
        dc      27*NUMPERSUBBAND        ;index = 10             = 324 bits
        dc      30*NUMPERSUBBAND        ;index = 11             = 360 bits
        dc      33*NUMPERSUBBAND        ;index = 12             = 396 bits
        dc      36*NUMPERSUBBAND        ;index = 13             = 432 bits
        dc      39*NUMPERSUBBAND        ;index = 14             = 468 bits
        dc      42*NUMPERSUBBAND        ;index = 15             = 504 bits
        dc      45*NUMPERSUBBAND        ;index = 16             = 540 bits
        dc      48*NUMPERSUBBAND        ;index = 17             = 576 bits

;This is the CCS compression table for number of bits
;       for data allocation by position

        dc      0*NUMPERSUBBAND         ;index = 0, no transmit = 0   bits
        dc      4*NUMPERSUBBAND         ;index = 1, packed      = 48  bits
        dc      6*NUMPERSUBBAND         ;index = 2, packed      = 72  bits
```

```
        dc      8*NUMPERSUBBAND         ;index = 3              = 96 bits
        dc      10*NUMPERSUBBAND        ;index = 4, packed      = 120 bits
        dc      12*NUMPERSUBBAND        ;index = 5              = 144 bits
        dc      15*NUMPERSUBBAND        ;index = 6              = 180 bits
        dc      18*NUMPERSUBBAND        ;index = 7              = 216 bits
        dc      21*NUMPERSUBBAND        ;index = 8              = 252 bits
        dc      24*NUMPERSUBBAND        ;index = 9              = 288 bits
        dc      27*NUMPERSUBBAND        ;index = 10             = 324 bits
        dc      30*NUMPERSUBBAND        ;index = 11             = 360 bits
        dc      33*NUMPERSUBBAND        ;index = 12             = 396 bits
        dc      36*NUMPERSUBBAND        ;index = 13             = 432 bits
        dc      39*NUMPERSUBBAND        ;index = 14             = 468 bits
        dc      42*NUMPERSUBBAND        ;index = 15             = 504 bits
        dc      45*NUMPERSUBBAND        ;index = 16             = 540 bits
        dc      48*NUMPERSUBBAND        ;index = 17             = 576 bits

;Each sub-band, if it is transmitted, must send scale factors.  The
;Sbit patterns determine how many different scale factors are transmitted.
;The number of scale factors transmitted may be 0, 1, 2 or 3.  Each scale
;factor requires 6 bits.
;
;Sbit patterns
;       00      Transmit all three scale factors         18 (3 * 6 bits)
;       01      Transmit the second two scale factors    12 (2 * 6 bits)
;       10      Transmit only one scale factor            6 (1 * 6 bits)
;       11      Transmit the first two scale factors     12 (2 * 6 bits)

;The NBits array is used to determine the number of bits to allocate for the
;scale factors. NSBITS (the 2 bits for SBits code) are added to account for
;all required scale factor bits (18+2,12+2,6+2,12+2).

NSKFBits
        dc      20,14,8,14

;This is the table for Signal to Noise ratio by position

        include '..\xmicro\snr.asm'

endbitalloc_xtbl
        endsec

        org     phe:

bitalloc

;Save the array starting addresses

        move    r0,y:BitsAdd            ;save register of SBits array
        move    r4,y:BPosAdd            ;save register of SubBandPosition array
        move    r5,y:BInxAdd            ;save register of SubBandIndex array

;select the ISO or CCS comperssion table for NDataBit:

        move    #NDataBit,r5            ;standard ISO table
        move    #18,n5                  ;offset to CCS compression table
        jclr    #0,y:<cmprsctl,_bita_20_A         ;if not applicable, continue
        move    (r5)+n5                 ;select the CCS compression table

_bita_20_A
        move    r5,x:ndatabit           ;set addr of NDataBit table for alloc
```


BAD ORIGINAL

```
;set up the MNR array

        move    #SBMsr,r5                   ;addr of Mask-to-Signal by sub-band

;apply the safety factor

        move    y:o_psych,y0                ;get the safety factor

;loop through all sub-bands

        do      #NUMSUBBANDS,_bita_30_A
        move    x:(r2)+,x0                  ;get a channel SBMax
        move    x:(r1)+,b                   ;get its channel MinMsk
        sub     x0,b                        ;MinMask - SBMax = Mask-to-Signal ratic
        sub     y0,b                        ;apply safety factor to channel value
        move    b,x:(r5)+                   ;store for test if below mask already

_bita_30_A                                  ;END of do loop

;set the working value for bits available for allocation

        move    y:audbits,x0                        ;get standard available bit cnt
        move    x0,y:<AvlBits                       ;store as working bit cnt

_bita_40_A

;
;(c)  TotBits = 0;                          /* start the bit allocation counter */
;
        clr     a         #>1,x1            ;total bit used, x1 = 1 for start index
        move    a,y1                        ;y1 = 0 to initialize
        move    a,y:<TotBits
        move    a,y:<count                  ;start the sub-band counter
        bclr    #AT_LIMIT_SUBBAND,y:<stereo     ;NOT yet at sub-band limit
                                            ; which require at least 1 allocation
        bclr    #AT_USED_SUBBAND,y:<stereo      ;NOT yet at sub-band maximum
                                            ; limit for coding used sub-bands

;
;initial allocation for all sub-bands;
;       1. that are within the use (less than UsedSubBands)
;       2. with a MinimumMasking to MaximumSignal above the masking threshold
;
        move    #SBMNRmax,r0                ;addr of de-alloc Max signal-noise
        move    #SBMsr,r1                   ;addr of Mask-to-Signal by sub-band
        move    y:BitsAdd,r2                ;set register of SBits array
        move    y:AllwAdd,n3                ;init the current Allow table
        move    y:BPosAdd,r4                ;set register of SubBandPosition array
        move    y:BInxAdd,r5                ;set register of SubBandIndex array
        move    #AtLimit,r6                 ;point to SubBandAtLimit array

;clear the n registers for the channel reference

        clr     a         #0,n0             ;SBMNRmax array
        move    a,n1                        ;SBMsr array
        move    a,n2                        ;SBits array
        move    a,n4                        ;SBPos array
        move    a,n5                        ;SBIndx array
        move    a,n6                        ;AtLimit array
```

```
;initial allocation pass
;do all required sub-bands

        do      #NUMSUBBANDS,_bita_990_A

;initialize the pertinent sub-band values to 0

        move    y1,x:(r6+n6)            ;clear allocated limit flag (AtLimit)
        move    y1,x:(r5+n5)            ;clear allocated index (SBIndx)
        move    y1,x:(r4+n4)            ;clear allocated position (SBPos)

;if we reached the used sub-band limit,
;  take this one out of the picture completely

        jset    #AT_USED_SUBBAND,y:<stereo,_bita_180_A

        move    y:<count,y0             ;get current sub-band (00-31)

;see if we reached the used sub-band limit

        move    y:<usedsb,b             ;get count of used subbands for testing
        cmp     y0,b                    ;see if sub-band not to be coded
        jgt     <_bita_50_A             ;if not, continue
        bset    #AT_USED_SUBBAND,y:<stereo      ;just reached sub-band maximum
        jmp     <_bita_180_A            ;take completely out of use

_bita_50_A

;if we reached the sub-band limit for those requiring at least one sub-band,
;  see if we have anything to allocate to get below the Global Masking Threshold

        jset    #AT_LIMIT_SUBBAND,y:<stereo,_bita_90_A

;see if at least one allocation is required regardless of signal to noise ratio

        move    y:<limitsb,a            ;get sub-band limit for at least 1 alloc
        cmp     y0,a                    ;if there is initial allocation
        jgt     <_bita_95_A             ;continue
        bset    #AT_LIMIT_SUBBAND,y:<stereo     ;just reached that limit

_bita_90_A

;otherwise, see if below Mask-to-Signal

        move    x:(r1+n1),a             ;get sub-band's Mask-to-Signal ratio
        tst     a                       ;test Mast-to-Sig for positive value
        jgt     <_bita_190_A            ;if below masking thresh, set flag

_bita_95_A

;find Signal-to-Noise position that puts Signal below Masking Threshold

        move    x1,r7                   ;start at 1st Signal-to-Noise position
        move    #SNR,n7                 ;addr of Signal-to-Noise table
        move    x:(r1+n1),y0            ;get signal to mask ratio

        do      #NUMSNRPOSITIONS-1,_bita_110_A

        move    x:(r7+n7),a             ;get the Signal-Noise at position
        add     y0,a                    ;add MNR to SNR for test
```

```
        jle     <_bita_100_A            ;still above mask, try next position

;now below the Global Mask, quit the loop

        enddo                           ;found position, stop #NUMSNRPOS-1 loop
        jmp     <_bita_110_A            ;go to end of loop

_bita_100_A

; try the next position and continue the loop

        move    (r7)+                   ;try next Sig-Noise position

_bita_110_A                             ;END of #NUMSNRPOSITIONS-1 do loop

        move    r7,y0                   ;save the matched SNR position
        move    y:MaxPos,a              ;to test if exceeded max position
        cmp     y0,a     y1,r3          ;is counted position greater than max
                                        ; & start at index 0 with allocation
        jge     <_bita_115_A            ;if not, go on to match the index
        move    a1,y0                   ;set position at the maximum position

_bita_115_A

;find index of the position that best matches the selected SNR position

        do      #NUMINDEXES,_bita_130_A

        move    x:(r3+n3),a             ;get the sub-band indexed position
        cmp     y0,a                    ;compare to selected position
        jlt     <_bita_120_A            ;match not found yet, try next index

;found the matching index, quit the loop

        enddo                           ;found index, stop #NUMINDEXES loop
        jmp     <_bita_130_A            ;go to end of loop

_bita_120_A

;try the next index and continue the loop

        move    (r3)+                   ;try position at next index

;see if end of the table line reached

        move    x:(r3+n3),a             ;get this next index to test
        tst     a                       ;test for an index of zero
        jne     <_bita_125_A            ;if not 0, keep looking

;index of zero indicates no higher indices apply, back up 1 and use that

        move    (r3)-                   ;use previous index
        bset    #ALLOCATE_LIMIT,x:(r6+n6)  ;set the completely allocated bit
        bset    #HEARING_LIMIT,x:(r6+n6)   ;set the completely allocated bit
        move    x:(r3+n3),a             ;assign the last index position
        enddo                           ;found index, stop #NUMINDEXES loop
        jmp     <_bita_130_A            ;go to end of loop

_bita_125_A
        nop                             ;keep looping
```


BAD ORIGINAL

```
_bita_130_A                                 ;END of #NUMINDEXES do loop

;set the initial allocation SubBandIndex and SubBandPosition

        move    r3,x:(r5+n5)                ;set initial allocation SBIndx
        move    a1,x:(r4+n4)                ;set initial allocation SBPos

;determine the number of scale factor bits allocated at this position

        move    x:(r2+n2),n7                ;get the SBits scale factor code (0-3)
        move    #NSKFBits,r7                ;addr SBits scale factor bit count tbl
        nop
        move    x:(r7+n7),y0                ;save the scale factor bit count

_bita_140_A

;add the bits required for the signal data

        move    x:(r4+n4),n7                ;get the position
        move    x:ndatabit,r7               ;address of data bit count by position
        nop
        move    x:(r7+n7),a                 ;get the bit count at this position
        add     y0,a      y:<TotBits,x0     ;add scale factor bits
                                            ; and get curr TotBits
        add     x0,a                        ;update TotBits with bits just allocated
        move    a,y:<TotBits                ;save new allocated total bits

;check that Signal-to-Noise position that Signal below Masking Threshold

        move    #SNR,r7                     ;addr of Signal-to-Noise table
        move    x:(r1+n1),y0                ;get signal to mask ratio
        move    x:(r7+n7),a                 ;get the Signal-Noise at position
        add     y0,a      x:(r5+n5),r3      ;add MNR to SNR for test
                                            ; & set up to set prev index for its pos
        jle     <_bita_160_A                ;above mask, skip next statement
        bset    #MASKING_LIMIT,x:(r6+n6)    ;set AtLimit partially done allocate

_bita_160_A

;set the value for testing the best sub-band to deallocate bits from
;if the frame cannot handle the full required allocation

        move    (r3)-                       ;back up one index to get that position
        move    x:(r3+n3),n7                ;get the position at the previous index
        nop
        move    x:(r7+n7),a                 ;get the Signal-Noise at position
        add     y0,a                        ;calc Sig-to-Noise at prev position
        move    a,x:(r0+n0)                 ;save in SBMNRmax array for later
        jmp     <_bita_200_A                ;continue with the next sub-band

_bita_180_A

;sub-band is not to be coded at all

        bset    #ALLOCATE_LIMIT,x:(r6+n6)   ;set AtLimit totally out of allocation
        bset    #HEARING_LIMIT,x:(r6+n6)    ;set AtLimit at threshold of hearing

_bita_190_A
```

BAD ORIGINAL

```
;sub-band is set to indicate it is at its masking threshold

        bset    #MASKING_LIMIT,x:(r6+n6)    ;set AtLimit partially done allocate

_bita_200_A

;finished the sub-band set up for the initial allocation of the next subband

        move    (r0)+                       ;next sub-band SBMNRmax
        move    (r1)+                       ;next sub-band SBMsr
        move    #16,r3                      ;to position to next Allowed sb table
        move    (r2)+                       ;next sub-band SBits
        move    (r3)+n3                     ;next sub-band Allowed table array
        move    r3,n3                       ;set addr for next sub-band Allowed pos
        move    (r4)+                       ;next sub-band SBPos
        move    (r5)+                       ;next sub-band SBIndx
        move    y:<count,r7                 ;get current sub-band count
        move    (r6)+                       ;next sub-band AtLimit
        move    (r7)+                       ;increment the sub-band counter
        move    r7,y:<count                 ;save new sub-band

_bita_990_A                                 ;END of #NUMSUBBANDS do loop

; done with the initial allocation phase, phase A
; set the de-allocation passes initial state of control flags

        bset    #MASKING_PASS,y:<stereo     ;flag do masking passes
        bclr    #HEARING_PASS,y:<stereo     ;allocate index must be > 1
        bclr    #FINAL_PASS,y:<stereo       ;NOT final passes

;see if frame fits or do we have to de-allocate selectively

        move    y:<TotBits,x0               ;get the total bits allocated
        move    y:<AvlBits,a                ;get available bits
        cmp     x0,a                        ;TotBits vs BitsAvailable
        jge     <_bita_990_B                ;if fits, allocate any leftover bits

        do      #1000,_bita_990_B

;test the bit allocation timout flag
; if the timer flag was trip, switch over to the final bit allocation
;       of any remaining bits

        jclr    #0,y:<qtalloc,_bita_10_B
;       jset    #FINAL_PASS,y:<stereo,_bita_10_B        ;continue, if final
        bset    #FINAL_PASS,y:<stereo   ;set for FINAL criteria

        enddo                               ;stop the #1000 loop and exit
        move    y:<TotBits,x0               ;get the total bits allocated
        jmp     <_bita_990_C                ;out of time, de-alloc under last basis

_bita_10_B

;now let's look for qualifying candidates for next de-allocation

        move    #SBMNRmax,r0                ;addr of de-alloc Max signal-noise
        move    y:BInxAdd,r5                ;set register of SubBandIndex array
        move    #AtLimit,r6                 ;point to SubBandAtLimit array
        move    #0,n0                       ;offset to the channel SBMNRmax
        move    n0,n5                       ;offset to chan SBIndx
```

```
        move    n0,n6                   ;offset to chan AtLimit
        move    #0,r2                   ;use r2 as a sub-band counter
        move    r2,y:<MNRsub            ;start cnt of de-allocate table entries
        move    #>1,x1                  ;to test for index of 1
        move    y:<limitsb,y1           ;to test for at least one alloc limit
        move    #MNRval,n3              ;get address of MNRval table
        move    #MNRsbc,n4              ;get address of MNRsbc table

;to deallocate the 1 index if the signal starts out below global mask

        move    #SBMsr,r1               ;addr of Mask-to-Signal by sub-band
        move    n0,n1                   ;offset to chan SBMsr

;loop thru the sub-bands

        do      y:<usedsb,_bita_80_B

;if no index has been allocated, try the next sub-band

        move    x:(r5+n5),a             ;check for an allocated index
        tst     a                       ;if zero, try the next sub-band
        jeq     <_bita_70_B             ;no allocation try next sub-band

;if the 3rd mode of selection, no checks are made

        jset    #FINAL_PASS,y:<stereo,_bita_60_B        ;3rd mode, use this one

;if 2nd mode of selection sub-band may be below the masking threshold, but
;       checks to make sure that if index allocated is ONE and that the
;       sub-band is not required for continity

        jset    #HEARING_PASS,y:<stereo,_bita_50_B      ;2nd mode num of index

;must be 1st mode of selection which requires that the sub-band
;   be below the masking threshold

        jclr    #MASKING_LIMIT,x:(r6+n6),_bita_70_B     ;skip: above mask thresh

_bita_50_B

;if we have allocated only 1 index, skip this sub-band if at least one
;       allocation is required

        cmp     x1,a                    ;see if index at 1
        jgt     <_bita_60_B             ;no, this sub-band qualifies

        move    r2,a                    ;get current sub-band
        cmp     y1,a                    ;see if sub-band below at least 1
        jge     <_bita_70_B             ;if greater, deallocation candidate
        move    #>14,y1                 ;if greater than 14, check
        cmp     y1,a    y:<limitsb,y1   ;test sb vs 14, restore limitsb to y1
        jlt     <_bita_70_B             ;if less than 14, keep the 1 allocation
        move    x:(r1+n1),b             ;get Max Signal to MinMask
        tst     b                       ;if positive, started below global mask
        jle     <_bita_70_B             ;if not positive, keep the 1 allocation

_bita_60_B

;candidate qualifies,
; insert this candidate into the table for initial de-allocation
```

```
        jsr     <insert_value

_bita_70_B

;advance to the next sub-band

        move    (r2)+                   ;increment the sub-band counter
        move    (r0)+                   ;next sub-band SBMNRmax
        move    (r5)+                   ;next sub-band SBIndx
        move    (r6)+                   ;next sub-band AtLimit

_bita_80_B                              ;end of y:<usedsb do loop

;if there are any entries in the de-allocate tables, start reclaiming bits

        move    y:<MNRsub,a             ;get the de-allocate table entry cnt
        tst     a                       ;test for zero, no entries
        jne     <_bita_110_B            ;are entries at this criteria, dealloc

;since there were no candidates to deallocate (MNRsub = 0),
; change the selection criteria:
;       if we've done the final criteria and nothing to de-allocate,
;               we can do nothing here, exit  (How Come???)
;       if we've not found anything with at least 2 indexes allocated,
;               switch to select from any sub-bands
;       if we've not found anything below the masking threshold,
;               switch to at least 2 indexes alloc
;
;redo the selection criteria

        jset    #FINAL_PASS,y:<stereo,_bita_095_B   ;??? shouldn't be, exit
        jset    #HEARING_PASS,y:<stereo,_bita_100_B
        jset    #MASKING_PASS,y:<stereo,_bita_105_B
        bset    #MASKING_PASS,y:<stereo
        jmp     <_bita_200_B            ;loop thru with this criteria

_bita_095_B
        enddo                           ;stop the #1000 loop and exit
        move    y:<TotBits,x0           ;get the total bits allocated
        jmp     <_bita_990_C

_bita_100_B
        bclr    #HEARING_PASS,y:<stereo
        bset    #FINAL_PASS,y:<stereo
        jmp     <_bita_200_B            ;loop thru with this criteria

_bita_105_B
        bclr    #MASKING_PASS,y:<stereo
        bset    #HEARING_PASS,y:<stereo
        jmp     <_bita_200_B            ;loop thru with this criteria

;there are entries in the de-allocate tables

_bita_110_B

;de-allocate from the table from 1st entry to last
; or until enough bits have been reclaimed

        clr     a
        move    a,y:<count              ;start counter thru the table
```

```
;loop through the ordered de-allocation table

        do      y:<MNRsub,_bita_190_B

        move    #MNRsbc,n0              ;address of MNRsbc table
        move    y:<count,r0             ;current table entry index
        nop
        move    x:(r0+n0),a             ;get selected sub-band
        move    a,y:MNRsb               ;store current sub-band (0-31)
        move    (r0)+                   ;increment to next table entry
        move    r0,y:<count             ;save next table entry

;restore the channel array addresses

        move    #SBMNRmax,r0            ;addr of de-alloc Max signal-noise
        move    #SBMsr,r1               ;addr of Mask-to-Signal by sub-band
        move    y:BitsAdd,r2            ;set register of SBits array
        move    y:BPosAdd,r4            ;set register of SubBandPosition array
        move    y:BInxAdd,r5            ;set register of SubBandIndex array
        move    #AtLimit,r6             ;point to SubBandAtLimit array

;set the proper allowed table of indexed position based on the selected sub-band

        move    y:AllwAdd,r3            ;init the current Allow table
        tst     a                       ;see if it's sub-band zero (from above)
        jeq     <_bita_150_B            ;sub-band zero was selected
        move    #16,n3                  ;to increment to next sub-band addr
        do      a,_bita_150_B           ;increment to sub-band number chosen
        move    (r3)+n3                 ;16 position entries per sub-band

_bita_150_B
        move    r3,n3                   ;set Allowed addr for sub-band chosen
        move    y:MNRsb,n0              ;get selected sub-band in SBMNRmax
        move    n0,n1                   ;sub-band in SBMsr
        move    n0,n2                   ;sub-band in SBits
        move    n0,n4                   ;sub-band in SBPos
        move    n0,n5                   ;sub-band in SBIndx
        move    n0,n6                   ;sub-band in AtLimit
        move    x:ndatabit,r7           ;address of data bit count by position
        move    y:<TotBits,a            ;get current bits allocated
        move    x:(r5+n5),r3            ;get the current allocated index
        move    x:(r4+n4),n7            ;get the position at the old index
        move    (r3)-                   ;back up one index
        move    r3,x:(r5+n5)            ;save new SBIndx for sub-band
        move    x:(r7+n7),x0            ;data bits allocated at that position
        sub     x0,a                    ;subtract old allocated data bits
        move    x:(r3+n3),n7            ;get new position
        move    n7,x:(r4+n4)            ;save new SBPos for sub-band
        move    x:(r7+n7),b             ;data bits allocated at new position
        add     b,a                     ;add new allocated data bits

        tst     b                       ;see if index 1 just de-allocated
        jne     <_bita_160_B            ;if not, save the new TotBits value

;we have to take off the scale factor bits

        move    x:(r2+n2),n7            ;get the SBits scale factor code (0-3)
        move    #NSKFBits,r7            ;addr SBits scale factor bit count tbl
        nop
```


BAD ORIGINAL

```
        move    x:(r7+n7),y0              ;get the scale factor bit count
        sub     y0,a                      ;subtract from TotBits

_bita_160_B

        move    a,y:<TotBits              ;save the new total bits

;check if Signal-to-Noise position that Signal above/below Masking Threshold

        bclr    #MASKING_LIMIT,x:(r6+n6)  ;clear AtLimit below masking threshold
        move    x:(r4+n4),n7              ;get the position
        move    #SNR,r7                   ;addr of Signal-to-Noise table
        move    x:(r1+n1),y0              ;get signal to mask ratio
        move    x:(r7+n7),a               ;get the Signal-Noise at position
        add     y0,a    x:(r5+n5),r3      ;add MNR to SNR for test
                                          ; & set up to set prev index for its pos
        jle     <_bita_170_B              ;above mask, skip next statement
        bset    #MASKING_LIMIT,x:(r6+n6)  ;set AtLimit below masking threshold

_bita_170_B

;check if the bit pool can now handle the frame as allocated

        move    y:<TotBits,a              ;get the new total bits
        move    y:<AvlBits,x0             ;get the available bits
        cmp     x0,a                      ;BitsAvailable vs TotBits
        jgt     <_bita_180_B              ;need more, continue with de-allocation

        enddo                             ;we're done here, stop MNRsub loop
        enddo                             ;we're done here, stop #1000 loop
        jmp     <_bita_990_B

_bita_180_B

;if there is no index allocated (r3 = 0), continue with the next table entry

        move    r3,a                      ;get newly decremented index allocated
        tst     a       (r3)-             ;if it is zero, continue
                                          ; & back up one index for that position
        jeq     <_bita_185_B              ;allocated index equals 0, continue

;set the value for testing the best sub-band to deallocate bits from
;if the frame cannot handle the full required allocation

        move    x:(r3+n3),n7              ;get the position at the previous index
        nop
        move    x:(r7+n7),a               ;get the Signal-Noise at position
        add     y0,a                      ;calc Sig-to-Noise at prev position
        move    a,x:(r0+n0)               ;save in SBMNRmax array for later

_bita_185_B
        nop                               ;continue y:MNRsub do loop

_bita_190_B                               ;end of y:MNRsub do loop
        nop

_bita_200_B
        nop                               ;continue #1000 do loop

_bita_990_B                               ;end of #1000 do loop
```

```
; set the allocation passes initial state of control flags

        bset    #MASKING_PASS,y:<stereo         ;flag do masking passes
        bclr    #HEARING_PASS,y:<stereo         ;NOT hearing threshold passes
        bclr    #FINAL_PASS,y:<stereo           ;NOT final passes

;get the total bits allocated so far

        move    y:<TotBits,x0

; Now that we have the initial bit allocation, iterate on it.
;
;(c)    for( LoopCount = 0; ; ++LoopCount ) {
;
        do      #1000,_bita_990_C

;test the bit allocation timout flag
; if the timer flag was trip, switch over to the final bit allocation
;       of any remaining bits

        jclr    #0,y:<qtalloc,_bita_10_C
        jset    #FINAL_PASS,y:<stereo,_bita_10_C
        bset    #FINAL_PASS,y:<stereo

;this is equivalent to the call to the c subroutine:
;
;(c) AllocateBits()
;
;inititial allocation is done, set-up for as needed allocation loop
;restore the left channel array addresses

_bita_10_C
        move    #SBMsr,r1               ;set register of SBMsr array
        move    y:BitsAdd,r2            ;set register of SBits array
        move    y:BPosAdd,r4            ;set register of SubBandPosition array
        move    y:BInxAdd,r5            ;set register of SubBandIndex array
        move    #AtLimit,r6             ;point to SubBandAtLimit array
;
;(c)            FirstTime = 1;          /*start run thru subbands this time */
;
        bset    #FIRST_TIME,y:<stereo   ;FirstTime = !0

;clear the n registers for the channel reference

        clr     a
        move    a1,y:<count             ;start the sub-band counter
        move    y:AllwAdd,r0
        move    #SNR,r3
        move    a,n1                    ;SBMsr array
        move    a,n2                    ;SBits array
        move    a,n4                    ;SBPos array
        move    a,n5                    ;SBIndx array
        move    a,n6                    ;AtLimit array

;go through all used sub-bands looking at only those
; that have not reached the allocation limit

        do      y:<usedsb,_bita_130_C
```

BAD ORIGINAL

```
;see if this sub-band's limit flag was set previously, and skip if it has

        jset    #ALLOCATE_LIMIT,x:(r6+n6),_bita_100_C ;skip subbnd reached limit

        jset    #FINAL_PASS,y:<stereo,_bita_40_C  ;pass skips below mask check

        jset    #MASKING_LIMIT,x:(r6+n6),_bita_100_C ;skip subband reached limit

_bita_40_C
        move    x:(r4+n4),a                 ;get curr position[SubBand]

;see if this sub-band has reached its limit already

        move    y:MaxPos,y0                 ;set max value
        cmp     y0,a      a1,n3             ;see if max position; move pos to n3
        jeq     <_bita_80_C                 ;reached its allocation limit, set flag

;check this sub-band out
; see if there is room to handle the next allocation for this sub-band

        clr     b         #>1,y1            ;init added scale factor bits
                                            ; & to incr to next allowed bits size
        move    x:(r5+n5),a                 ;SubBandIndex[SubBand]

;if this will be the 1st index, we must account for the scale factor bits

        tst     a         #NSKFBits,r7      ;see if 0
                                            ; & set addr of NSKFBits array
        jne     <_bita_50_C                 ;not 1st index, skip add scale bits

;set the scale factor + sbits needed for this 1st index in this sub-band

        move    x:(r2+n2),n7                ;get SBIts index
        nop
        move    x:(r7+n7),b                 ;num bits for scaling info

_bita_50_C

        add     y1,a      x:ndatabit,r7     ;incr, get addr of NDataBIts
        move    a1,n0                       ;set offset for Allowed next index

;see if next allocation is passed the max for this sub-band as per Allowed table

        nop
        move    x:(r0+n0),a                 ;get the NextPosition as the new pos
        tst     a         a1,n7             ;see if passed the maximum position
                                            ; & move new pos to n7
        jeq     <_bita_80_C                 ;reached its allocation limit, set flag

;test the allocation at this new position

        move    x:(r7+n7),y1                ;get NDataBits[NextSBPos]
        add     y1,b      n3,n7             ;add to any scaling info bits
                                            ; & set offset SubBandPos[SubBand];
        move    b1,y1                       ;bits to add for next index
        move    x0,b                        ;b==>TestBits = OldTotBits
        move    x:(r7+n7),y0                ;get NDataBits[SBPos[SubBand]]

        sub     y0,b      a1,x1             ;TestBits -= current bits
                                            ; & put new position in proper reg
```

```
        add     y1,b    y:<AvlBits,a    ; TestBits += next allocation bits
                                        ;  & gets BitsAvaliable
;
;(c)            if( TestBits > BitsAvailable ) {
;(c)                    AtLimit = 1;
;(c)                    continue;
;(c)            }
;
        cmp     b,a     b,y:TotBits     ;see if room & save allocation
        jlt     <_bita_80_C             ; no room, set as AtLimit and continue

;if this is the final loop, skip the next test and allocate the bits

        jset    #FINAL_PASS,y:<stereo,_bita_70_C  ;pass skips below mask check

;
;(c)            SMR = SubBandMax[SubBand]
;(c)                            - MinMaskingDb[SubBand]
;(c)            MNR = SNR[SubBandPosition[SubBand]] - SMR
;
        move    x:(r3+n3),y1            ;get SNR[SubBandPos[SubBand]]
        move    x:(r1+n1),a             ;SBMsr[SubBand] Mask-to-Signal
        add     y1,a    y:MNRmin,b      ;add Sig-Noise ratio;
                                        ; & get MNRmin for below
        jgt     <_bita_90_C             ;below Masking, go to take out partially

        move    a,y1                    ;save MNR
        jset    #FIRST_TIME,y:<stereo,_bita_60_C  ;if first, save as minimum
        cmp     y1,b                    ;MNRmin - MNR
        jle     <_bita_100_C

_bita_60_C
        move    n0,y:MNRinx             ;MNRinx = NewIndex;
        move    x1,y:MNRpos             ;MNRpos = NewPosition;
        move    y:<TotBits,x1           ;get the allocation of bits
        move    x1,y:<HldBits           ;save the allocation of bits
        move    y:<count,x1             ;get current sub-band
        move    x1,y:MNRsb              ;MNRsb = SubBand;
        move    y1,y:MNRmin             ;MNRmin = MNR;
        bclr    #FIRST_TIME,y:<stereo   ;clear FirstTime flag
        jmp     <_bita_100_C

;we are on the final allocations passes after all sub-bands
;       are driven below the Global Masking threshold

_bita_70_C
        move    y:<TotBits,x0           ;save new TotBits
        move    n0,x:(r5+n5)            ;save new sub-band index
        move    x1,x:(r4+n4)            ;save new allocation position
        bclr    #FIRST_TIME,y:<stereo   ;clear FirstTime flag
        jmp     <_bita_100_C

_bita_80_C
        bset    #ALLOCATE_LIMIT,x:(r6+n6)  ;set the completely allocated bit
        bset    #HEARING_LIMIT,x:(r6+n6)   ;set the completely allocated bit

_bita_90_C
        bset    #MASKING_LIMIT,x:(r6+n6)   ;set the reached global masking bit

_bita_100_C
```

```
        move    y:<count,r7             ;get current sub-band to increment
        move    #16,n0                  ;now update Allowed to next sub_band
        move    (r1)+                   ;SBMsr array
        move    (r2)+                   ;SBits array
        move    (r4)+                   ;SBPos array
        move    (r5)+                   ;SBIndx array
        move    (r6)+                   ;AtLimit array
        move    (r0)+n0                 ;advance Allowed to next sub-band
        move    (r7)+                   ;increment the sub-band counter
        move    r7,y:<count             ;save new sub-band number

_bita_130_C

; At this point the following registers are in use
;       y:AvlBits = # of bits available
;       y:MNRsb = MNRsb
;       y:MNRMin = MNRmin

;We test now to see if this trip thru the loop produced any changes
; and if not, we have finished the bit allocation for this frame.
;
;(c)    if( FirstTime )
;(c)            return;
;
        jclr    #FIRST_TIME,y:<stereo,_bita_140_C  ;not 1st, alloc to selected
        jclr    #FINAL_PASS,y:<stereo,_bita_160_C  ;not final, set 1 more loop

;finished, end the loop and go to exit routine

        enddo
        jmp     <_bita_990_C

_bita_140_C

;test flag all candidates are below masking threshold

        jset    #FINAL_PASS,y:<stereo,_bita_170_C  ;if final, allocated already

;restore the channel array addresses

        move    y:BPosAdd,r4            ;set register of SubBandPosition array
        move    y:BInxAdd,r5            ;set register of SubBandIndex array

;       SubBandIndex[MNRsb]++
;       SubBandPosition[MNRsb] = AllowedPositions[MNRsb][SubBandIndex[MNRsb]]

        move    y:MNRsb,n5              ;MNRsb
        move    n5,n4                   ;MNRsb
        move    y:MNRinx,x1             ;get the saved new index
        move    x1,x:(r5+n5)            ;update the SBIndx for selected sub-band
        move    y:MNRpos,x1             ;get the saved new Allowed position
        move    x1,x:(r4+n4)            ;update the SBPos for selected sub-band
        move    y:<HldBits,x0           ;set the new bit allocation total cnt
        jmp     <_bita_170_C            ;continue major loop

;now lets just allocate what's left now that all are below mask

_bita_160_C
        bset    #FINAL_PASS,y:<stereo   ; just loop now
```

BAD ORIGINAL

```
_bita_170_C
        nop

_bita_990_C

        move    x0,y:<TotBits               ;save bits actually allocated
        move    y:<AvlBits,b                ;determine number of bits padded
        sub     x0,b                        ;bits available minus total allocated
        move    b1,y:padbits                ;save count of unallocated audio bits

        rts

;insert_value():
;
;This routine orders the table of values per sub-band
;that are to be de-allocated as needed. The table is ordered in
;descending sequence that makes the 1st entry the one that can best
;afford a deallocation.

;on entry:
;
;       x:(r0+n0) = the current value to be inserted
;       r2 = the sub-band number to be inserted
;       y:MNRsub = current count of entries in the ordered deallocation tables
;       n3 = address of MNRval table
;       n4 = address of MNRsbc table
;
;on exit:
;
;       y:MNRsub = incremented count of entries in ordered deallocation tables
;
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       y0 = destroyed
;       r3 = destroyed
;       r4 = destroyed

        org     phe:

insert_value

;get the current value to be inserted and set upo the start into
; the ordered table of values and the assoicated table of sub-band

        move    x:(r0+n0),a                 ;get the current value to insert
        move    y:<MNRsub,b                 ;get current count of table entries

;if this is the 1st value to be inserted ino the table, skip the
; search for its place and enter this as table entry no 1

        tst     b       #0,r3               ;see if this is 1st entry into table
                                            ; & set to 1st entry in MNRval table
        jeq     <_insert_50                 ;if 1st, skip following table search

;search through the table of entries so far established looking for where
;to store this current value

        do      y:<MNRsub,_insert_20
```

BAD ORIGINAL

```
        move    x:(r3+n3),x0            ;get the table value for comparison
        cmp     x0,a                    ;against the new value to be inserted
        jlt     <_insert_10             ;if less, value is further down table

;when the new value is greater than or equal to the table entry,
; this is its place in the table, we may have to shift the following
; table entries in order to enter this new value

        enddo                           ;stop the y:MNRsub do loop
        jmp     <_insert_20             ;see if the table must be shifted

_insert_10
        move    (r3)+                   ;try the next table entry

_insert_20                              ;end of y:MNRsub do loop

;if this entry number (its place in the table) equals the count of entries,
; this entry will be the new LAST entry in the table

        move    r3,x0                   ;get its place in the table to compare
        cmp     x0,b                    ;its place to current table entry count
        jgt     <_insert_25             ;if less, we have to shift the table
        jeq     <_insert_50             ;if eq, entry is appended to the table
        move    b1,r3                   ;?? let's make sure we use last entry
        jmp     <_insert_50

_insert_25

;we need to shift the subsequent entries in the table down one and then
; insert this new sub-band value

        move    b1,r3                   ;establish the curr table ends
        move    b1,r4                   ;for both MNRval and MNRsbc
        move    (r3)+n3                 ;set r3 with addr of MNRval end + 1
        move    (r4)+n4                 ;set r4 with addr of MNRsbc end + 1
        move    (r3)-                   ;back off 1 to get last MNRval entry
        sub     x0,b    (r4)-           ;number of table entries to shift
                                        ; & back off 1 to get last MNRsbc entry

        do      b,_insert_40            ;shift each down 1 position in tables

        move    x:(r3)+,y0              ;get curr value and incr to rec addr
        move    y0,x:(r3)-              ;put value 1 entry down & back up 1
        move    x:(r4)+,y0              ;curr sub-band/chan & incr to rec addr
        move    y0,x:(r4)-              ;put value 1 entry down & back up 1
        move    (r3)-                   ;back up one more entry table MNRval
        move    (r4)-                   ;back up one more entry table MNRsbc

_insert_40                              ; end of b do loop

;restore entry location to receive value and sub-band

        move    x0,r3

_insert_50

;insert the current value at this location in the ordered table
; also insert the sub-band number

        move    r3,r4                   ;matching position in the MNRsbc table
```

```
        move    a,x:(r3+n3)             ;enter sorted value
        move    r2,x:(r4+n4)            ;enter the sub-band number

;increment the count of entries in the ordered deallocation tables

        move    y:<MNRsub,r3            ;we need to increment entry counter
        nop
        move    (r3)+
        move    r3,y:<MNRsub            ;save the new table entry count

        rts
```

```
        opt     fc
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\botsallo.asm

        title   'Initialize bit output'

; This routine is used to initialize the bit output routines.

        include 'def.asm'
        include 'box_ctl.asm'

        section lowmisc
        xdef    sc,curwd

        org     yli:
stbitsallo_yli

sc      ds      1                               ;shift count
curwd   ds      1                               ;current word

endbitsallo_yli
        endsec

        org     phe:

;bitpool()
;       This subroutine determines the number of bits available based
;       on the output bit rate and the type of framing
;
;*****************************************************************************
;The table below is based on a Sampling Rate at 48,000 /sec and shows
;the breakdown of bit counts based on bit rate o/p and choice of frame type
;                   Mono        Full      <------------ Joint Stereo ------------->
;kb     frame                  Stereo      4-bound    8-bound    12-bound   16-bound
;rate   bits      fix avail   fix avail   fix avail  fix avail  fix avail  fix avail
;----   ----      --- -----   --- -----   --- -----  --- -----  --- -----  --- -----
;384    9216      136  9080   224  8992   152  9064  168  9048  183  9033  195  9021
;256    6144       .   6008    .   5920    .   5992   .   5976   .   5961   .   5949
;192    4608       .   4472    .   4384    .   4456   .   4440   .   4425   .   4413
;128    3072       .   2936    .   2848    .   2920   .   2904   .   2889   .   2877
;112    2688       .   2552    .   2464    .   2536   .   2520   .   2505   .   2493
; 96    2304       .   2168    .   2080    .   2152   .   2136   .   2121   .   2109
; 64    1536       .   1400    .   1312    .   1384   .   1368   .   1353   .   1341
; 56    1344      136  1208   224  1120   152  1192  168  1176  183  1161  195  1149
;*****************************************************************************
;
;       y:<stereo = flags:
;                 test bit indicating applicablation of CRC-16 protection
;                         0 = NOT APPLICABLE
;                         1 = CRC-16 protection APPLIES
;
;
;       y:frmbits = the total number of bits in a frame at the specified
;                 bit rate
;
;
; on exit:
;       x0 destroyed = returned number of required (fixed) bits
;       x1 destroyed = returned number of bits available for bit allocation
;
```

```
;       a  destroyed
;       r0 destroyed
;       r1 destroyed
;       r3 destroyed
;

        org     phe:

bitpool

;Select the proper Allowed table:
; ISO:
;       1. for low sampling rates (24 or 16 K),
;               set ISO Extention Allowed table (Allowed_3)
;       2. for high sampling rates (48, 44.1 or 32 K):
;               a. based on MAXSUBBANDS less than 27,
;                       set ISO lower bit rate Allowed table (Allowed_2)
;               b. else,
;                       set ISO higher bit rate Allowed table (Allowed_1)
; CCS:
;       set ISO higher bit rate Allowed table (Allowed_1)

;low sampling rate:
;   test the frame header ID bit (if 0, it's a low sampling rate frame)

        move    #smplidbit,r0           ;addr of frame header ID bit (0 = low)
        nop                             ;                            (1 = high)
        jset    #0,y:(r0),_bitp_000_A   ;if high rate, select Allowed table

        move    #Allowed_3,r0           ;addr of low sampling allowed table
        move    #skftbl_3,r1            ;addr of the BAL bits table
        move    #>15,x1                 ;maximum position Allowed_3 table
        jmp     <_bitp_010_A            ;go to store Allowed table address

_bitp_000_A

;high sampling rate:
; set the proper Allowed table address based on working MAXSUBBANDS (y:<maxubs:
; if less than 27, used table 2

        move    y:<maxsubs,x0           ;get current MAXSUBBANDS
        move    #>27,a                  ;to see which of 2 tables applies
        move    #>17,x1                 ;maximum position Allowed_1 table
        move    #skftbl_1,r1            ;addr of the BAL bits table
        cmp     x0,a    #Allowed_1,r0   ;see if need the low bit rate table
                                        ; & set up as Allowed_1 table
        jle     <_bitp_010_A            ;Allowed_1 table applies

;select the lower bit rate Allowed table

        move    #Allowed_2,r0
        move    #skftbl_2,r1            ;addr of the BAL bits table
        move    #>16,x1                 ;maximum position Allowed_2 table

_bitp_010_A

;set the address of the selected Allowed table
;set the address of the selected BAL's bit table
;set the maximum position code
```

```
        move    r2,y:AllwAdd
        move    r1,x:skftbl
        move    x1,y:MaxPos

;determine the bits required for ancillary data (taken from audio pit pool):
;  start with bits required to store the padded data byte count in frame

        move    #>BITSFORPADDING,b        ;bits in the padded byte count
        move    y:maxbytes,y1             ;get max bytes at baud rate
        move    y:<bytecnt,a              ;get current count of bytes received
        cmp     y1,a    #>BITSPERBYTE,x1        ;see max versus current count
                                          ; & set multiplier
        jge     <_bitp_00                 ;if more than max, can only send max
        move    a,y1                      ;less than max, send all received

_bitp_00

;multiply the bytecount for bits per byte

        mpy     x1,y1,a                   ;to get the required bit
        asr     a       y1,y:<bytesfrm    ;shift integer result
                                          ; & set byte count for framing
        move    a0,a
        add     a,b                       ;add to the count of bytes

        move    b,y:ancbits               ;set ancillary data bit count

;set the number of fixed bits used, and the number of available bits for audio

        clr     a       #0,x1             ;0 a as accum, zero CRC checksum bit cnt

;set the address and bit offsets to identify the end of the current full frame
; and set the end of the formatted frame

        move    y:<frmnext,r1             ;address for start the next frame
        move    y:<outsize,m1             ;circular ctl addr the framing o/p buf

;set the fixed bits for the audio frame

        move    #>NSYNC,x0                ;number of SYNC bits
        add     x0,a    #>NSYST,x0        ;plus number of bits in frame system hdr
        add     x0,a    x:skftbl,r0       ;get base of used bits table

        jclr    #PROTECT,y:<stereo,_bitp_35 ;skip checksum bits if no protect
        move    #>NCRCBITS,x1             ;add applicable bits for the checksum

_bitp_35
        add     x1,a                      ;add checksum protection, if any

;account for the bits required for protection encoding

        move    #>REED_SOLOMON_BITS,x1    ;bits required for Kadir's routine
        add     x1,a                      ;add protection bits to fixed bit cnt

;accummulate the bit allocation bits for standard number of sub-bands
; included in the frame for the left and right (if applicable)

        do      y:<maxsubs,_bitp_50

;accumulate for the channel
```

```
        move    x:(r0)+,x1
        add     x1,a

_bitp_50
        move    a,x0                    ;return fixed bits
        move    y:frmbits,b             ;total size of frame in bits

;subtract any bits required for ancillary data

        move    y:ancbits,y1
        sub     y1,b

_bitp_80
        sub     a,b                     ;total bits - fixed bits
        move    b,x1                    ;return number of audio data bits avail

;now determine word and bit offsets for the end of the audio frame

        add     y1,b                    ;restore bits for ancillary data
        add     a,b     #>24,y1         ;restore to full audio frame size
                                        ; & set number bits in a word
        move    y:<frmstrt,r1           ;count words to last word in frame

_bitp_90
        cmp     y1,b                    ;see if reached last word
        jlt     <_bitp_100              ;if so, set eoframe word & bit offsets
        sub     y1,b    (r1)+
        jmp     <_bitp_90

_bitp_100
        move    r1,y:audendw            ;to identify end of audio part of frame
        move    b,y:audendb             ;bit offset end of audio part of frame
        move    y:<linear,m1            ;reset to linear buffer control

        rts

;bitsallo()
;       This subroutine starts the bit allocation of values into the
;       frame buffer values are inserted by setvalue() and by bitfree() below

; on exit
;       y:<sc = 0
;       y:<curwd = initialized (0) 1st word in frame buffer
;       a = destroyed

bitsallo
        move    #0,a
        move    a,y:<sc                 ;initialize the shift count
        move    a,y:<curwd              ;initialize curwd (1st bit in op frame

        rts

        page
;bitsfree()
;       This routine flushes the last bits to the output buffer
;
; on entry
;       r6 = address of next word the output frame buffer (x memory
```

```
; on exit
;       a = destroted
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed

        section highmisc
        xdef    audendw
        xdef    audendb

        org     yhe:
stbitsallc_yhe

audendw ds      1               ;address of end of audio portion of frame
audendb ds      1               ;bit offset to end of audio portion of frame

endbitsallo_yhe
        endsec

bitsfree

;see if all of the frame has been output totally

        move    y:<frmnext,x1           ;get address for start of next frame
        move    r6,b                    ;next o/p address of current frame
        cmp     x1,b    #>24,a          ;if addresses = start, done
                                        ; and set up for the next test
        jeq     <_free_90               ;frame done, exit

;see if the last word of the frame is to be output next

        move    y:<frmlast,x1           ;last word address of current frame
        cmp     x1,b    y:<sc,x0        ;test if address = last word
                                        ; and get number of bits in last word
        jeq     <_free_20               ;last word, chk block seq number needed

;output last partially formatted data word before zero fill remainder of frame

        sub     x0,a    #>24,x0         ;get number of bits left
        cmp     x0,a    #0,x0           ;24 - number of bits left
        jeq     <_free_05               ;not partially formatted  y:sc == 0

        move    y:<curwd,b              ;get current output word
        rep     a                       ;output the necessary # of bits
        lsl     b

        move    b1,x:(r6)+              ;save in the output
        move    x0,y:<sc                ;zero the current bit offset

_free_05                                ;output zero for remainder of frame
        clr     a

_free_10
;see if the last word of the frame is to be output next

        move    r6,b                    ;next o/p address of current frame
```

```
        cmp     x1,b                    ;see if last word next
        jeq     <_free_20               ;last word, chk block seq number needed
        move    a1,x:(r6)+              ;output frame word and incrment addr
        jmp     <_free_10               ;continue to flush the buffer

_free_20
        move    #0,y0                   ;init with zeros to pad last word
        move    #0,x0                   ;init with no bits req for seq number
        move    #>24,a                  ;bits in the word
        move    y:<sc,y1                ;get current formatted word offset
        sub     y1,a                    ;bits remaining
        sub     x0,a                    ;bits required for block seq num
        tst     a                       ;test if any zero bits to output
        jle     <_free_90               ;if none, try the block seq num

        move    a,n4                    ;number of bits to output
        jsr     <setvalue               ;pad word with zeroes as needed

_free_90
        rts
```

```
        opt     fc,mex
;
; (c) 1995. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \DGCST\xmicrmus.asm: Reed Solomon version for DigiCast

        title   'Micro MUSICAM Transitter Main'

; (7/23/92) xmicro.asm micro MONO version of XPSYCHO and XCODE combined

        include 'def.asm'
        include '..\common\ioequ.asm'
        include 'box_ctl.asm'

        section lowmisc

        xdef    word_out
        xdef    word_in

        xdef    startyli
        xdef    not_appl
        xdef    maxsubs
        xdef    oldccs
        xdef    usedsb
        xdef    stereo
        xdef    cmprsctl
        xdef    oprptr
        xdef    outmus
        xdef    outsize
        xdef    frmstrt
        xdef    frmnext
        xdef    frmlast
        xdef    timer
        xdef    timeout
        xdef    qtalloc
        xdef    ipwptr
        xdef    polyst
        xdef    nmskfreqs
        xdef    maxcritbnds
        xdef    linear
        xdef    junk
        xdef    endyli

        xdef    dbgcnt
        xdef    limitsb

        org     yli:

stxmicro_yli

word_out        ds      1       ;applicable hardware output (leds, switches)
word_in         ds      1       ;applicable hardware input (switches, lines)

startyli

not_appl        ds      1       ;satisfy non-applicable hardware settings

maxsubs ds      1               ;working MAXSUBBANDS for sample/bit rate
oldccs  ds      1               ;encode MPEG-ISO or old CCS CDQ1000's
                                ;       0 = MPEG-ISO
```

```
                                        ;       1 = old CCS CDQ1000's
usedsb  ds      1                       ;number of used sub-bands
stereo  ds      1                       ;y:<stereo = flags:
                                        ;bit 0 means stereo vs mono framing
                                        ;  0 = stereo framing
                                        ;  1 = mono framing
                                        ;bit 1 indicates left vs right channel
                                        ;  0 = looping thru left channel arrays
                                        ;  1 = looping thru right channel arrays
                                        ;bit 2 indicates joint stereo applies
                                        ;  0 = NOT joint stereo framing type
                                        ;  1 = IS joint stereo framing type
                                        ;bit 3 indicates curr frame upgraded to
                                        ; full stereo by joint bit allocation
                                        ;       (if joint stereo applies)
                                        ;  0 = normal joint stereo allocation
                                        ;  1 = FULL STEREO allocation
                                        ;bit 4 indicates the stereo intensity
                                        ; sub-band boundary has been reached
                                        ;       (if joint stereo applies)
                                        ;  0 = NO sub-bands still below
                                        ;       intensity boundary
                                        ;  1 = sub-bands above intensity
                                        ;       boundary
                                        ;bit 5 is FirstTime switch in a loop
                                        ; thru the bit allocation
                                        ;  0 = cleared if any allocations
                                        ;       were made
                                        ;  1 = no allocations made to any
                                        ;       sub-band
                                        ;bit 6 indicates a below masking
                                        ;       threshold allocation pass
                                        ;  0 = some sub-bands not below mask
                                        ;  1 = all sub-bands are below mask
                                        ;bit 7 indicates a below hearing
                                        ;       threshold allocation pass
                                        ;  0 = some sub-bands not below hearing
                                        ;       threshold
                                        ;  1 = all sub-bands are below hearing
                                        ;       threshold
                                        ;bit 8 indicates final bit allocation
                                        ; passes to use up any available bits
                                        ;  0 = not yet
                                        ;  1 = allocate remainder in bit pool
                                        ;bit 9 indicates limit of sub-bands requiring
                                        ; at least one position has been reached:
                                        ;  0 = not yet, 1 = limit reached
                                        ;bit 10 indicates maximum limit of sub-bands
                                        ; that are to be allocated has been reached:
                                        ;  0 = not yet, 1 = limit reached
                                        ;
cmprsctl        ds      1               ;control flag for CCS compression:
                                        ; bit 0 = application:
                                        ;       0 = ISO standard
                                        ;       1 = CCS compression applies
oprptr  ds      1                       ;read pointer into output frame buffer
outmus  ds      1                       ;number of words to read in
outsize ds      1                       ;circular buffer ctl frame o/p buffer
frmstrt ds      1                       ;starting addr of current frame
frmnext ds      1                       ;starting addr of next frame
```

```
frmlast ds      1                ;last word addr of current frame
timer   ds      1                ;0.024/0.036 msec timer interrupt sensor
timeout ds      1                ;0.024/0.036 msec timer interrupt exception
qtalloc ds      1                ;0.024/0.036 msec timer interrupt bit alloc
                                 ; signal bit allocator to finish up
ipwptr  ds      1                ;write pointer into input inpcm buffer
polyst  ds      1                ;addr of the polyanalysis start
nmskfreqs       ds      1        ;NMSKFREQS based on selected sample rate
maxcritbnds     ds      1        ;MAXCRITBNDS based on selected sample rate
linear  ds      1                ;reset mX as linear buffer control

junk    ds      1       ;!!!debug

endyli

dbgcnt  dc      0       ;!!!debug counter of flag
limitsb dc      0       ;LIMITSUBBANDS  ;sub-bands req at least 1 allocation

endxmicro_yli

        endsec

        section ptable

        xdef    ptable
        xdef    a_psych,b_psych
        xdef    c_psych,d_psych
        xdef    e_psych,f_psych,g_psych
        xdef    h_psych,i_psych,j_psych
        xdef    k_psych,l_psych,m_psych,n_psych,o_psych,p_psych
        xdef    q_psych,r_psych,s_psych,t_psych,u_psych,v_psych,w_psych,x_psych
        xdef    y_psych,z_psych
        xdef    z1_psych,z2_psych,z3_psych,z4_psych,z5_psych,z6_psych

        org     yli:
stptable_yli

ptable

;this table is known as IRT

a_psych         dc  0.0467146       ;A curval=   9 dB
b_psych         dc  0.0498289       ;B curval=   .3 dB/Bark
c_psych         dc  0.0259526       ;C curval=   5 dB
d_psych         dc  0.0498289       ;D curval=   .3 dB/Bark
e_psych         dc  0.0882387       ;E curval=  17 dB/Bark
f_psych         dc  0.4000000       ;F curval=   .4 1/Bark
g_psych         dc  0.0311431       ;G curval=   6 dB/Bark
h_psych         dc  0.0882387       ;H curval=  17 dB/Bark
i_psych         dc  0.0882387       ;I curval=  17 dB/Bark
j_psych         dc  0.1000000       ;J curval=   .1 1/Bark
k_psych         dc  0.0000000       ;K curval=   0.0000000
l_psych         dc  0.0000000       ;L curval=   0.0000000
m_psych         dc  0.0000000       ;M curval=   0.0000000
n_psych         dc  0.0000000       ;N: CCS compression = NO < .5 >= YES
o_psych         dc  0.0000000       ;O curval=   0.0000000
p_psych         dc  0.0000000       ;P curval=   0.0000000
q_psych         dc  0.0000000       ;Q curval=   0.0000000
r_psych         dc  0.0000000       ;R curval=   0.0000000
s_psych         dc  0.0000000       ;S curval=   0.0000000
```

```
t_psych         dc  0.0000000          ;T curval=   0.0000000
u_psych         dc  0.0000000          ;U curval=   0.0000000
v_psych         dc  0.0000000          ;V curval=   0.0000000
w_psych         dc  0.0000000          ;W curval=   0.0000000
x_psych         dc  0.0103810          ;X curval=   2 dB/Bark
y_psych         dc  0.0259525          ;Y curval=   5 dB/Bark
z_psych         dc  0.0415239          ;Z curval=   8 dB/Bark
z1_psych        dc  0.0000000          ;Z1 curval=   0.0000000
z2_psych        dc  0.0000000          ;Z2 curval=   0.0000000
z3_psych        dc  0.0000000          ;Z3: 4 to 30 = used sub-bands (mono)
z4_psych        dc  0.0000000          ;Z4 curval=   0.0000000
z5_psych        dc  0.0000000          ;Z5 curval=   0.0000000
z6_psych        dc  0.0000000          ;Z6 curval=   0.0000000

endptable_yli
        endsec

        section highmisc

        xdef    startyhe

        xdef    bitrate
        xdef    frmrate
        xdef    smplcde
        xdef    smplrte
        xdef    smplidbit
        xdef    bndwdth
        xdef    frmtype
        xdef    opfrtyp
        xdef    baudrte
        xdef    oputcde
        xdef    frmbits
        xdef    fixbits
        xdef    audbits
        xdef    ancbits
        xdef    stintns
        xdef    b_i
        xdef    fmap
        xdef    ThresSLB
;       xdef    Threshld
        xdef    cb
        xdef    g_cb
        xdef    dbaddtbl
        xdef    plctmn

        xdef    endyhe

        xdef    samplng
        xdef    bitrates
        xdef    baudclk

        org     yhe:

stxmicro_yhe

startyhe

bitrate ds      1               ;bit rate code for MUSICAM frame header
                                ; sampling rate 48 K or 32 K:
                                ;   ISO and old CCS CDQ1000:
```


BAD ORIGINAL

```
                                ;       3 (0011) = 56 KBits
                                ;       4 (0100) = 64 KBits
                                ; sampling rate 24 K or 16 K:
                                ;   ISO:
                                ;       7 (0111) = 56 KBits
                                ;       8 (1000) = 64 KBits
                                ;   old CCS CDQ1000:
                                ;       3 (0011) = 56 KBits
                                ;       4 (0100) = 64 KBits
frmrate ds      1               ;overall frame bit rate as to hardware
                                ;   switches (1 bit) indicate
                                ; bit rate sets numb words in a frame:
                                ;       0 = low Kbit rate
                                ;       1 = high Kbit rate
smplcde ds      1               ;sample rate code in MUSICAM header:
                                ;  ISO:
                                ;       00 = 44.1 K or 22.05 K
                                ;       01 = 48 K or 24 K
                                ;       10 = 32 K or 16 K
                                ;  old CCS CDQ1000:
                                ;       00 = 16 K
                                ;       01 = 48 K
                                ;       10 = 32 K
                                ;       11 = 24 K
smplrte ds      1               ;PCM data sampling rate: low vs high rate
                                ; depending on flag in box_ctl.asm that
                                ; indicates the pairing (16/24, 16/32, 16/48,
                                ;       24/32, 24/48 or 32/48)
                                ;   switches (1 bit) indicate
                                ;       0 = 16000, 24000 or 32000
                                ;       1 = 24000, 32000 or 48000
smplidbit       ds      1       ;hdr id bit:
                                ;  ISO:
                                ;       1 for 44.1, 48, and 32 K sample rates
                                ;       0 for 22.05, 24, and 16 K sample rates
                                ;  old CCS CDQ1000:
                                ;       1 is always used with special sample
                                ;         rate codes in the header (above)
bndwdth ds      1               ;code for setting sub-band limits
frmtype ds      1               ;dip switches (2 bits) are set to:
                                ;       11 = (3) mono (1 channel)
opfrtyp ds      1               ;current frame type after bit allocation
baudrte ds      1               ;ancillary data baud rate
outcde ds       1               ;type of output coding: MUSICAM vs G722
                                ;   switches (1 bit) indicate
                                ;       0 = MUSICAM frames
                                ;       1 = G722 data
frmbits ds      1               ;bits in the audio portion of frame
fixbits ds      1               ;bits required before audio data bits
audbits ds      1               ;number of bits available for audio data
ancbits ds      1               ;bits required for ancillary data current frame
stintns ds      1               ;intensity subband boundary code
b_i             ds      1       ;addr b_i table for low or high sample rate
fmap            ds      1       ;addr fmap table for low or high sample rate
ThresSLB        ds      1       ;addr ThresSLB table for low or high sample rate
;Threshld       ds      1       ;addr Threshld table for low or high sample rate
cb              ds      1       ;addr cb table for low or high sample rate
g_cb            ds      1       ;addr g_cb table for low or high sample rate
dbaddtbl        ds      1       ;addr DbAddTbl
plctmn  ds      1               ;successive phase lock detect high center main
```

```
endyhe
;table of sampling rates
        SAMPLERATES
;table of bit rates
        BITRATES
;baud rate table for ancillary data
        BAUDCLK
endxmicro_yhe
        endsec
        org     phe:
start
; The external wait state is set to 1.  This allows the HCT541's to
; put their data on the bus in plenty of time.
        movep   #$0001,x:<<M_BCR        ;set all external io wait states
;set dsp56002 clock to selected MHz (PLL Control Register)
        XCODE_M_PCTL
;  PORT C Assignments
;
;  s = ssi port
;  i = input port
;  o = output port
;
        XCODE_PORT_C_M_PCC              ;set port C control register
        XCODE_PORT_C_M_PCD              ;set output data to port C
        XCODE_PORT_C_M_PCDDR            ;set port C data direction reg
; initialize the ssi port for the ad converter
        XCODE_SSI_M_CRA                 ;set ssi cra register
        XCODE_SSI_M_CRB                 ;set ssi crb register
; initialize the sci port for tty
        XCODE_SCI_M_SCR                 ;set sci status control register
;  PORT B Assignments
;
; 14 13 12 - 11 10 9 8 - 7 6 5 4 - 3 2 1 0
;  o  o  i     o  i i o   o i i i   i i i i
;
        XCODE_PORT_B_M_PBC      ;set B control register for general IO
        XCODE_PORT_B_M_PBD      ;set the default outputs
```

```
        XCODE_PORT_B_M_PBDDR    ;set B register direction

;initialize the host interrupt vector

        INIT_HOST_VECTORS_CD

restart

; set the interrupt for host interrupts
; HOST set to IPL 2

        movep   #>$080C,x:<<M_IPR         ;set int priorities and edges
        andi    #$fc,mr                   ;turn on the interrupt system
;
        ori     #$03,mr
        nop
        nop
        nop

;clear the analog to digital converter to restart calibration

        CLR_ADC_RESET

;disable the ancillary data received interrupt

        bclr    #M_RIE,x:<<M_SCR

        move    #>OFF_LEDS_CD,b           ;initialize leds as off
        move    b,y:<word_out

;**********************************************************************
;**********************************************************************
; TEST NOTICE THAT THE FOLLOWING DATA IS ENCODED AND PUT INTO A HIGH MEMORY
; AND WILL BE CHCKED WOTH THE CODED DATA ALL THE TIME WHILE THE PROGRAM
; RUNS TO MAKE SURE THAT NONE OF A WORD IS IN ERROR
;TEST DATA

;initialize the buffer to be encoded for testing

        OFF_REED_SOL_LED_CD               ;indicate no problem with Reed Solomon
        move    #framebuf,r0              ;code the 1st of the encoded frames
        clr     a       #>1,x0            ;zero the test value accumulator
                                          ; & to increment in the test buffer

;set the frame buffer to sequentially incremented values

        do      #96,_init1
        add     x0,a
        move    a1,x:(r0)+
_init1

;do the reed solomon encoding on the test frame buffer

        move    #framebuf,r0              ;i/p pointer of buffer to be RS-CODED
        move    #$bf,m0                   ;frame buffer is circular - 2 frames
        move    #reedsolbuf,r1            ;o/p pointer for CODED data to be stored
        jsr     <new_rs                   ;encode via reed solomon

;test if the reed solomon codec worked or NOT
```

```
        move    #reedsolbuf,r0           ;o/p pointer for CODED data to be stored
        move    #RStest,r1               ;pointer for the verification table

;verify that the reed solomon coded values are correct

        do      #96,_RS_Chk
        move    x:(r0)+,x0               ;Get current coded data output
        move    x:(r1)+,a                ;Get precoded  look up table value
        cmp             x0,a             ;compare 2 values
        jeq             <_Same           ;If SAME No problem
        ON_REED_SOL_LED_CD               ;indicate no problem with Reed Solomon
        enddo
        nop
_Same
        nop
_RS_Chk

        ON_ALARM_LED_CD                  ;light alarm led indicator
        TST_SET_ALARM_RELAY_CD,_set_led_0       ;unless already set,
        SET_ALARM_RELAY_CD               ;set the alarm relay line on

_set_led_0
        SET_LEDS_CD
        INTERRUPT_HOST_CD                ;inform the host

; Clear all of the y memory

        clr     a                        ;value to set x memory to
        move    #$ffff,m0                ;just in case, set to linear buffer
        move    #startyli,r0             ;set starting address low y-memory
        move    #(endyli-startyli),r1    ;set loop count
        rep     r1                       ;clear it
        move    a,y:(r0)+
        move    #startyhe,r0             ;set starting address high y-memory
        move    #(endyhe-startyhe),r1    ;set loop count
        rep     r1                       ;clear it
        move    a,y:(r0)+

;set linear buffer control

        move    m0,y:<linear

;set the CRC-16 protection checksum as applicable and set the
; CRC-16 checksum mono frame bit count for the old ISO method:
;  a. header bits covered by any type of frame
;       plus bits for the left channel also apply to any type of frame
;  b. save old ISO bit count for this frame

        bset    #PROTECT,y:<stereo       ;checksum protection applies (1=YES)
        move    #>CRC_BITS_A+CRC_BITS_B,a   ;header plus one channel bits
        move    a,x:crcold               ;set the old ISO CRC-16 bit count

;check the switches to determine bit rate and framing type
;get the external switches to determine:
;  PCM input data sampling rate
;  type of audio compression to format for output (MUSICAM/G722)
;  if MUSICAM, the frame bit rate
;  if MUSICAM, ancillary data baud rate

        GET_SWITCHES_CD gsws_00
```

```
        jsr     <getsws

        move    x:tstsmpl,y1
        move    y1,y:smplrte            ;set PCM data sampling rate code
        move    x:tstfrme,y1
        move    y1,y:frmtype            ;set type of frame (mono) to code
        move    x:tstband,y1
        move    y1,y:bndwdth            ;set bit allocation sub-band width code
        move    x:tstcode,y1
        move    y1,y:oputcde            ;type of encoded output (MUSICAM/G722)
        move    x:tstrate,y1
        move    y1,y:frmrate            ;set the frame rate i/p code
        move    x:tstbaud,y1
        move    y1,y:baudrte            ;set ancillary data baud rate code
        move    x:tstoccs,y1
        move    y1,y:<oldccs            ;set MPEG-ISO vs old CCS CDQ1000's

;set framing mode led

        move    y:frmtype,x0            ;set current frame type
        move    x0,y:opfrtyp            ;set current frame type for output to

;indicate mono framing (only frame type supported)

        bset    #STEREO_vs_MONO,y:<stereo

;based on sample rate (low or high) set the addresses for various tables:

        move    y:smplrte,b
        tst     b
        jne     <_hi_tables

        move    #b_ilo,r0               ;address of b_i table for low rate
        move    #fmaplo,r1              ;address of fmap table for low rate
        move    #ThrSLBlo,r2            ;address of ThresSLB table for low rate
;       move    #Thrhldlo,r3            ;address of Threshld table for low rate
        move    #cblo,r4                ;address of cb table for low rate
        move    #g_cblo,r5              ;address of g_cb table for low rate

;indicate coding at low sampling rate for compression

        bclr    #LOW_vs_HIGH_SAMPLING,y:<stereo

        jmp     <_set_tables

_hi_tables
        move    #b_ilo,r0               ;address of b_i table for high rate
        move    #fmaplo,r1              ;address of fmap table for high rate
        move    #ThrSLBlo,r2            ;address of ThresSLB table for high rate
;       move    #Thrhldlo,r3            ;address of Threshld table for high rate
        move    #cblo,r4                ;address of cb table for high rate
        move    #g_cblo,r5              ;address of g_cb table for high rate

;indicate coding at high sampling rate for compression

        bset    #LOW_vs_HIGH_SAMPLING,y:<stereo

_set_tables
        move    r0,y:b_i                ;set addr of b_i table selected
        move    r1,y:fmap               ;set addr of fmap table selected
```

```
        move    r2,y:ThresSLB            ;set addr of ThresSLB table selected
        move    r3,y:Threshld            ;set addr of Threshld table selected
        move    r4,y:cb                  ;set addr of cb table selected
        move    r5,y:g_cb                ;set addr of g_cb table selected
        move    #DbAddTbl_6db,r3
        move    r3,y:dbaddtbl

;based on the sampling rate and framing bit rate selected:
;       set the sampling rate code for the ISO frame header
;       set the framing bit rate code for the ISO frame header
;       set the frame  size in words and bits
;       set the applicable bit allocation control parameters

        move    #samplng,r0              ;addr of sampling rate codes
        move    y:smplrte,b              ;offset to sampling code table
        tst     b       #10,n0           ;test for sampling rate of zero
                                         ; & set register to advance thru table
        jeq     <_smplcds_               ;if code is zero, we're there

        rep     b
        move    (r0)+n0                  ;position to selected sampling rate code

_smplcds_
        move    y:(r0)+,x0               ;get ISO frame header sampling code
        move    x0,y:smplcde             ;save ISO code to encode in frame header
        move    y:(r0)+,x0               ;get ISO frame header id bit
        move    x0,y:smplidbit           ;set ISO frame header id bit
        move    y:(r0)+,x0               ;get mono channel MAXSUBBANDS
        move    x0,y:<maxsubs            ;set working MAXSUBBANDS
        move    (r0)+                    ;step over dual channel MAXSUBBANDS
        move    #4,n0                    ;in case of MPEG-ISO
        bclr    #0,y:<cmprsctl           ;CCS compression is not applicable
        jclr    #0,y:<oldccs,_smplcffs_  ;if MPEG-ISO, skip over old CDQ1000's

;encoding old CCS CDQ1000

        move    y:(r0)+,x0               ;old CDQ1000 frame header sampling code
        move    #smplidbit,r1            ;to check ISO frame header id bit
        move    x0,y:smplcde             ;save old code to encode in frame header
        jset    #0,y:(r1),_no_compress_  ;if ISO high sampling, no compression
        bset    #0,y:<cmprsctl           ;do CCS compression encoding

_no_compress_
        move    y:(r0)+,x0               ;get old CDQ1000 frame header id bit
        move    x0,y:smplidbit           ;set ISO frame header id bit
        move    y:(r0)+,x0               ;get mono channel MAXSUBBANDS
        move    x0,y:<maxsubs            ;set working MAXSUBBANDS
        move    (r0)+                    ;step over dual channel MAXSUBBANDS
        jmp     <_aftscds_               ;continue

_smplcffs_

;MPEG-ISO encoding

        move    (r0)+n0                  ;skip over old CCS CDQ1000 values

_aftscds_
        move    y:(r0)+,x0               ;get MAXCRITBNDS value @ sample rate
        move    x0,y:<maxcritbnds        ;set MAXCRITBNDS at selected sampling
        move    y:(r0),x0                ;get NMSKFREQS value @ sample rate
```

```
        move    x0,y:<nmskfreqs              ;set NMSKFREQS at selected sampling
        move    y:frmrate,b                  ;test bit rate to set audio data size
        move    #bitrates,r0                 ;addr of framing bit rate info
        tst     b           #8,n0            ;test for rate of zero
                                             ; & set register to advance thru table
        jeq     <_bit_offs_                  ;if code is zero, we're there

        rep     b
        move    (r0)+n0                      ;position to selected bit rate code

_bit_offs_

;set the table offset based on sampling rate

        move    y:smplrte,b                  ;get the sample rate code
        tst     b           #4,n0            ;test if low sampling rate
                                             ; & set offset to proper sampling rate
        jeq     _bit_smpl_                   ;if low rate, addr is set

        rep     b
        move    (r0)+n0                      ;position to selected sample rate

_bit_smpl_
        jclr    #0,y:<oldccs,_bit_cds_       ;if MPEG-ISO, continue
        move    (r0)+                        ;adv to old CCS CDQ1000's code

_bit_cds_
        move    y:(r0)+,n1                   ;get bit rate code for frame header
        jset    #0,y:<oldccs,_aftbcd_        ;if old CCS CDQ1000's, continue
        move    (r0)+                        ;skip over old CCS CDQ1000 code

_aftbcd_
        move    y:(r0)+,y1                   ;selected bit rate frame size in words
        move    y:(r0),r2                    ;number of audio bits in an output frame

        move    n1,y:bitrate                 ;audio bit rate code for frame hdr
        move    y1,y:<outmus                 ;set # of words in a frame
        move    r2,y:frmbits                 ;musicam audio portion of frame

;set bandwidths based on sampling rate, bit rate and band width selection

        move    y:smplrte,b                  ;set bandwidths based on sampling rate
        move    y:frmrate,a                  ;set bandwidths based on frame bit rate

;       jsr     <bandwidth

        move    y:z3_psych,a                 ;get the selected sub-bands, if any
        move    a,y:<usedsb                  ;set initial used sub-band value
        move    #>MINSUBBANDS_CCS,x0         ;set minimum sub-bands to be used
        cmp     x0,a     #>MAXSUBBANDS_CCS,x0    ;see if subs is too small
                                             ; & set default value of maximum
        jlt     <_default_used_00            ;if less, default the used sub-bands
        cmp     x0,a                         ;see if less than maximum sub-bands
        jlt     <_after_used_00              ;if less, we're ok

_default_used_00

;default the used sub-bands to max sub-bands

        move    x0,y:<usedsb
```

```
_after_used_00

;calculate buffer length controls

        move    #>2,x1
        mpy     x1,y1,a #>1,x1          ;set the mod buffer for 2 frames
        asr     a                       ;align integer result
        move    a0,a                    ;shift integer result
        sub     x1,a                    ;(frame numb words * 2) - 1

;now save the above buffer control values

        move    a1,y:<outsize           ;set circular buffer ctl for o/p buffer

;set the type of stereo intensity code as nominal 4 subbands (not applicable

        move    #>INTENSITY_4,x0        ;stereo intensity code for default of 4
        move    x0,y:stintns            ;save for frame header info

; Set output write read pointer to something safe since interrupts will
; be on before it is set properly.

        move    #framebuf,r0            ;address of output encoded frames buffer
        move    r0,y:<oprptr            ;set the output read buffer

;set up for ancillary data to be decoded from a framed and transmit via rs232
;       a. zero the input data byte counter and bytes for current frame
;       b. set address of clock table, baudclk, based on baud rate (0 thru 7)
;       c. set table offset by baud rate;
;          (these are standard CDQ2000 set by macro, BAUDCLK, in box_ctl.asm):
;               0 = 300 baud
;               1 = 1200 baud
;               2 = 2400 baud
;               3 = 3200 baud
;               4 = 4800 baud
;               5 = 38400 baud
;               6 = 9600 baud
;               7 = 19200 baud
;       d. set transmit enable (for xon/xoff
;       e. get and set the clock for baud rate from the table
;       f. get and set the max bytes for baud rate from the table
;       g. set the data input and output pointers
;       h. set receive enable
;       i. set receive enable interrupt

        move    #0,x0                   ;zero the received data counter
        move    x0,y:<bytecnt           ;zero the byte counter
        move    x0,y:<bytesfrm          ;zero the current frame byte counter
        move    #baudclk,r0             ;get data baud rate table address
        move    y:baudrte,b             ;set to access clock at baud rate
        tst     b       #3,n0           ;test for rate of zero
                                        ; & set register to advance thru table
        jeq     <_baudrte_              ;if code is zero, we're there

        rep     b
        move    (r0)+n0                 ;position to selected baud rate code

_baudrte_
        move    y:(r0)+,r2              ;get clock value at baud rate
```

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```
        move    y:smplrte,n0            ;now get sampling rate offset
        move    #databytes,x0           ;get addr of the data byte buffer
        move    y:(r0+n0),n1            ;get max byte count at sampling rate
        move    n1,y:maxbytes           ;store maxbytes for scixmt to check
        move    x0,y:<dataiptr          ;address for next byte received
        move    x0,y:<dataoptr          ;addr for next byte to output to frame
        movep   r2,x:<<M_SCCR           ;set the clock for selected baud rate
        bset    #M_RE,x:<<M_SCR         ;set receive enable
        bset    #M_RIE,x:<<M_SCR        ;data expected set receive interrupt
        bset    #M_TE,x:<<M_SCR         ;set transmit enable

;enable the host command interrupt

        bset    #M_HCIE,x:<<M_HCR

; Set and clear a flag so we can set the scope trigger.

        ON_BITALLOC_LED_CD              ;set a different flag for debug
        OFF_BITALLOC_LED_CD

; Now form the two pointers to the output buffer.
; frmstrt is the write pointer and frmnext is the read pointer.
; frmstrt is used to point to where the current buffer is for outputting
; data into. This data is a result of the current musicam coding.
; frmnext is used to point to the address for outputting of data
; to the external device.

        move    #framebuf,r0            ;address of the output frame buffer
        move    y:<outmus,n0            ;set the output read ptr
        move    y:<outsize,m0           ;set the output buffer circular ctl
        move    r0,y:<frmstrt           ;1st frame at start of buffer
        move    (r0)+n0                 ;advance to start of 2nd frame
        move    r0,y:<oprptr            ;set the output read buffer
        move    r0,y:<frmnext           ;set the next frame to write into
        move    (r0)-                   ;set up last word addr of curr frame
        move    r0,y:<frmlast           ;for block sequence numbering
        move    y:<linear,m0            ;reset to linear buffer

;set number of fixed bits required, and the number of available bits for audio

        jsr     <bitpool

        move    x0,y:fixbits            ;save fixed bit count
        move    x1,y:audbits            ;save bit count available for alloc

;initialize for receiving data for xpcycho routines

        move    #inpcm,r0               ;get the input pcm data buffer
        move    r0,y:<ipwptr            ;set start address for input pcm data
        move    #xbuf,r0                ;set starting position in x buffer
        jsr     <polyaini               ;init the poly analysis filter

; IRQA set to IPL 3, negative edge (lowest priority)
; SSI  set to IPL 3
; IRQB set to IPL 3, negative edge (highest priority)
; HOST set to IPL 2
; SCI  set to IPL 3

        movep   #>$f83f,x:<<M_IPR       ;set int priorities and edges
```

```
;wait for the dust to settle before pushing onward

;       move    #>XCODE_STARTUP,a
;       jsr     <wait

        SET_ADC_RESET                   ;stop A to D calibration

;test MUSICAM versus G722:
;       if MUSICAM, go to the TOP of frame processing
;       if G722, jump to that routine and restart upon return

        move    y:oputcde,a             ;MUSICAM vs G722
        tst     a                       ;if zero,
        jeq     <_go_on_                ;it's MUSICAM, enter that loop
;       jsr     <g722                   ;handle G722

;G722 output selected, boot up XMCRG722 from the low portion of chip

        bclr    #11,x:<<M_PBD           ;clr boot c000 for XMCRG722 boot (0000)
        jmp     <bootup                 ;boot in XMCRG722
;       jmp     <restart                ;restart with new switches

_go_on_

;handle MUSICAM encoding

        andi    #$fc,mr                 ;turn on the interrupt system

;main loop thru the frames of data set up by the left and right
; xpsycho dsp for bit allocation and framing by the xcode dsp

top
;!!!dbg
        nop
        nop
;       move    y:dbgcnt,a
;       move    #>1,x0
;       add     x0,a
;       move    a,y:dbgcnt
;       jmp     <_init1
;!!!dbg

;!!!dgcst       bset    WATCH_DOG               ;tickle the dog
;!!!dgcst       bclr    WATCH_DOG               ;tickle the dog
        TOGGLE_WATCH_DOG_CD

;get the external switches to determine if any changes that signal a restart

        GET_SWITCHES_CD gsws_10
        jsr     <getsws
        jclr    #4,y:<not_appl,_lets_go ;!!!debug - remove for normal

;test MUSICAM versus G722:
;       if G722, jump to restart
;       if MUSICAM, continue

;       move    x:tstcode,a             ;MUSICAM vs G722
;       tst     a                       ;if zero, it's MUSICAM
;       jne     <restart                ;it's G722, start over to boot
```

BAD ORIGINAL

```
;!!!2/8/93
        TST_SET_G722_DATA_CD,restart
;!!!2/8/93

;we have to restart with new framing criteria,
; protect the decoding of frames by clearing 2 successive frame

        move    y:<frmstrt,r6           ;set starting for output buffer
        move    y:<outsize,m6           ;set the output buffer circular ctl
        clr     a

        do      y:<outmus,_clear_1      ;clear the 1st frame
        move    a,x:(r6)+

_clear_1

;!!!2/8/93
        TST_SET_G722_DATA_CD,restart
;!!!2/8/93

        jclr    #0,y:<timer,_clear_1    ;check for new frame
        bclr    #0,y:<timer
        move    y:<frmnext,r6           ;set starting for output buffer

        do      y:<outmus,_clear_2      ;clear the 2nd frame
        move    a,x:(r6)+

_clear_2

;!!!2/8/93
        TST_SET_G722_DATA_CD,restart
;!!!2/8/93

        jclr    #0,y:<timer,_clear_2    ;check for new frame
        bclr    #0,y:<timer

        move    y:<linear,m6            ;restore to linear buffer control

        jmp     <restart                ;let's start anew

_lets_go

;initialize stereo control settings to reflect current transmission

        jsr     <setctls

        jclr    #0,y:<timer,top         ;check for new frame
        bclr    #0,y:<timer
        bclr    #0,y:<qtalloc           ;clr 0.024/0.036 msec timer bit alloc

;now set the used sub-bands for this frame

        move    y:z3_psych,a            ;get the selected sub-bands, if any
        move    a,y:<usedsb             ;set initial used sub-band value
        move    #>MINSUBBANDS_CCS,x0    ;set minimum sub-bands to be used
        cmp     x0,a    #>MAXSUBBANDS_CCS,x0    ;see if subs is too small
                                        ; & set default value of maximum
        jlt     <_default_used_10       ;if less, default the used sub-bands
        cmp     x0,a                    ;see if less than maximum sub-bands
        jlt     <_after_used_10         ;if less, we're ok
```

```
_default_used_10

;default the used sub-bands to max sub-bands

        move    x0,y:<usedsb

_after_used_10

;set the CCS compression as per control parameter (n_psych)

        bclr    #0,y:<cmprsctl          ;default as do not use CCS compression
        move    y:n_psych,a             ;get the parameter from the table
        move    #.5,x0                  ;if less than .5, no CCS compress
        cmp     x0,a                    ;see if use CCS compression or not
        jlt     <_nc_compress           ;if less, do not use CCS compression
        bset    #0,y:<cmprsctl          ;otherwise, set flag to use CCS compress

_nc_compress

;the new data for the next frame is all set, lets do it

        jsr     <doframe

        INTERRUPT_HOST_CD               ;inform the host
;pass the MUSICAM encoded frame off for reed solomon encoding

        move    y:<frmstrt,r0           ;set starting for output buffer
        move    y:<outsize,m0           ;set the output buffer circular ctl
        move    #reedsolbuf,r1          ;set starting for output buffer
        jsr     <new_rs                 ;call Reed Solomon encoding routine

;!!!dbg
;       jmp     <top    ;!!!dbg: skip Reed Solomon
;!!!dbg
;copy the reed solomon encode frame into the output frames buffer

        move    y:<frmstrt,r0           ;set starting for output buffer
        move    y:<outsize,m0           ;set the output buffer circular ctl
        move    #reedsolbuf,r1          ;set starting for output buffer
        do      y:<outmus,_copy_rs
        move    x:(r1)+,x0
        move    x0,x:(r0)+

_copy_rs
        jmp     <top

        end     start
```

```
        opt     fc,mex
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\autosmpl.asm: modified to coordinate with BEN's mux

        title   'Decoder Auto Determine Sampling Rate'

; This routine attempts to determine the sampling rate of MUSICAM frame of
; input data being fed to a MUSICAM decoder. It tries to match on the
; selected bit rate a corresponding sampling rate that are predefined for
; the given units capabilities.

;on entry:
;       y:frmrate = indicates which bit rate was selected
;       y:<ctlglgs = NO_LINES bit is set as to whether split frames possible
;       x:maxtries = the number of attempts at framing that should be made
;                    before determining that the input data is not MUSICAM

        include 'def.asm'
        include '..\common\ioequ.asm'
        include 'box_ctl.asm'
        include 'box_smpl.asm'
        include 'box_tbls.asm'

        section highmisc
        xdef    syncptrn

        org     yhe:
stauto_yhe

syncptrn        ds      4               ;4 possible sync & hdr patterns

endauto_yhe
        endsec

        section lowmisc
        xdef    synccnt
        xdef    syncmtch
        xdef    syncwrds
        xdef    syncbits
        xdef    syncfrms
        xdef    synced

        org     yli:
stauto_yli

synccnt         ds      1               ;count of sync patterns to check
syncmtch        ds      1               ;pattern matched (odd=padded)
syncwrds        ds      1               ;words per frame (if pad diff -1)
syncbits        ds      1               ;bit offset to frame start
syncfrms        ds      1               ;number of frame to sync up on
synced          ds      1               ;count of frames sync'ed

endauto_yli
        endsec

        section highmisc
;!!!BEN
        xdef    srchrate                ;!!!BEN
```


BAD ORIGINAL

```
        xdef    srchtries               ;!!!BEN
;!!!BEN
        xdef    maxtries
        xdef    tstsmpl
        xdef    fndbit
        xdef    fndsmpl
        xdef    fndidbit
        xdef    padbit
        xdef    sampletable

        org     xhe:
stautc_xhe

;!!!BEN
srchrate        dc      0       ;index to rates in sample rate table
srchtries       dc      0       ;failure counter of auto sample attempts
;!!!BEN
maxtries        dc      0       ;current auto determine max tries
tstsmpl         dc      0       ;sample code under test
fndbit          dc      0       ;bit rate code from frame header
fndsmpl         dc      0       ;verify found sampling rate selection
fndidbit        dc      0       ;verify found sampling rate id bit
padbit          dc      0       ;save padding bit from the header

        SAMPLETABLE             ;table for sample rate auto determination

endautc_xhe
        endsec
        org     phe:

autosample

        CLR_DAC_RESET                   ;clear the DAC reset line to mute output

;!!!BEN
;;;turn off the interrupt system
;;
;;      ori     #$03,mr
;;
;;; Now set priorites of the IRQA and SSI peripherals
;;; IRQA priority = 2
;;; IRQB priority = 3
;;; SSI  priority = 2
;;; SCI  priority = 2
;;
;;      movep   #>$a03e,x:<<M_IPR       ;set int priorities and edges
;!!!BEN

_autc_AA

        jset    #AUTONEXTFRAME,y:<process,_auto_continue

;build up the frame length table based on the selected bit rate

        move    #sampletable,r0         ;addr of sample rate frame lengths
        move    #AUTOBYSAMPLE,n0        ;set auto sample offset to next rate
        move    x:srchrate,b            ;get next rate index to search for
        tst     b                       ;see if 1st sample rate in table
        jeq     _auto_BB                ;if so, skip address adjustment
```

```
        do        b,_auto_BB                   ;for index count, adj table addr
        move      (r0)+n0                      ;advance to next sample rate

_auto_BB

;!!!BEN
;;;for the number of sampling rates supported, set table of frame lengths
;;
;;      do        #NUMSAMPLERATES,_auto_900

;7/12/94: test sampling rate as not applicable to current project

;;      move      r0,y:<svereg                 ;save current table address
        move      x:(r0)+,b                    ;get rate applicable code (0 = APPLIES)
        bclr      #1,y:oldccs                  ;clear y:oldccs frames CDQ1000 flag
        tst       b                            ;see if not applicable (-1 = N/A)
        jlt       _auto_800                    ;if N/A, go to try next sampling rate

;now test for framing on old CDQ1000 low sampling rate old frames

        jeq       _auto_A                      ;if zero, not old ccs CDQ1000 frames
        bset      #0,y:oldccs                  ;indicate old CCS
        bset      #1,y:oldccs                  ;indicate old CDQ1000 frames
        bset      #DECOMPRESS_PACKED,y:<ctlflgs   ;handle CCS compression

_auto_A

;get the MUSICAM frame header ID bit that indicates high vs low sampling rates

        move      x:(r0)+,x0                   ;get the high/low rate hdr id bit
        move      x0,y:smplidbit               ;save for translate rate code
        move      r0,r1                        ;address of entries at sample rate

;translate the raw bit rate code to the internal rate index code
;  based on whether the sampling rate is high (y:smplidbit 1=high) or low (0)
;and validate that the rate is supported by the software and/or hardware

        move      #translaterates,r0           ;addr of the translation table
        move      y:rawrate,n0                 ;to offset to translated index
        nop
        move      (r0)+n0                      ;pos to bit rate translate 1st value
        move      (r0)+n0                      ;pos to bit rate translate 2nd value
        move      y:smplidbit,n0               ;low (0) or high (1) sample rate select
        move      #>-1,a                       ;to see if not supported
        move      y:(r0+n0),x0                 ;get the translated rate index code
        cmp       x0,a                         ;see if not supported rate
        jeq       _auto_800                    ;not supported, try next sampling rate

;set the supported framing bit rate table index code

        move      x0,y:frmrate                 ;bit rate index code

;set up the framing patterns table at sampling rate/framing bit rate

        move      #AUTOBYBITRATE,n1            ;numb parameters per bit rate
        move      y:frmrate,b                  ;get the defined bit rate
        tst       b         x:(r1)+,x0         ;test if code zero
                                               ; & set table sample rate code
        jeq       _auto_00                     ;if zero, skip addr adjustment
        rep       b                            ;position to selected bit rate
```

```
        move    (r1)+n1

_auto_00
        move    x0,x:tstsmpl            ;save sample rate code

;build up the table of framing patterns at this sample/bit rate

        move    #syncptrn,r2            ;table of framing patterns to match

;set at least the 1st two patterns: unpadded and padded (possibly)

        move    x:(r1)+,b               ;get 1st defined framing pattern
        tst     b       b,x0            ;if 1st pattern is zero, not valid
                                        ; & save 1st defined framing pattern
        jeq     _auto_800               ;bit rate not supported @ sample rate
        move    x0,y:(r2)+              ;insert the pattern in test table
        move    x:(r1)+,b               ;get 2nd defined framing pattern
        tst     b       #>1,x1          ;if pattern zero (NO padding possible)
                                        ; & set pattern count to 1 (at least)
        jeq     _auto_10                ;if zero, use 1st pattern over again
        move    b,x0                    ;else, use the padded framing pattern
        move    #>2,x1                  ;set pattern count to 2

_auto_10
        move    x0,y:(r2)+              ;insert 2nd pattern in test table

;now if split mono framing is possible, set up to look for those frames

        jclr    #NO_LINES,y:<ctlflgs,_auto_20 ; NOT appl if one or both lines
        move    x:(r1)+,b               ;get 3rd defined framing pattern
        tst     b       b,x0            ;if pattern zero (NOT split frames)
                                        ; & in case of duplication as 4th
        jeq     _auto_20                ;if zero, NOT eligible for split frames
        move    x0,y:(r2)+              ;insert 3rd pattern in test table
        move    x:(r1)+,b               ;get 2nd defined framing pattern
        tst     b       #>3,x1          ;if pattern zero (NO padding possible)
                                        ; & set pattern count to 3
        jeq     _auto_20                ;if zero, use 1st pattern over again
        move    b,x0                    ;else, use the padded framing pattern
        move    #>4,x1                  ;set pattern count to 4
        move    x0,y:(r2)+              ;insert 4th pattern in test table

_auto_20

;set count of framing patterns inserted in the framinb pattern table

        move    x1,y:<synccnt           ;set the pattern count for framing

;get the frame length values at this sample/bit rate

        move    #framevalues,r0         ;addr of sample rate values
        move    #FRAMEBYSAMPLE,n0       ;numb parameters per sample rate
        move    x:tstsmpl,b             ;to see if need to adjust address
        tst     b                       ;if code 0, no need to shift address
        jeq     _auto_40                ;if 0, get the 3 parameters

;adjust the table address to proper sampling rate parameters

        rep     b
        move    (r0)+n0
```

```
_auto_40
        move    #FRAMEBYBITRATE,n0      ;numb parameters per framing bit rate
        move    y:frmrate,b             ;test bit rate to set audio data size
        tst     b                       ;if code 0, no need to shift address
        jeq     _auto_50                ;if 0, get the parameters

;adjust the table address to proper framing bit rate parameters at sample rate

        rep     b
        move    (r0)+n0

_auto_50
        move    y:(r0)+,r1              ;get the words per frame at rate
        move    r1,n1                   ;to calc circular doubled buffer ctl
        move    (r0)+                   ;skip the bit count per frame
        move    (r1)+n1                 ;double framing buffer
        move    (r1)-                   ;for circular double buffer ctl
        move    r1,y:frmemod            ;save framing circ buffer ctl
        move    y:(r0)+,b               ;get any padded frames DIFF value
        tst     b       n1,r1           ;to see if word count adj needed
                                        ; & restore frame length in words
        jeq     _auto_60
        move    (r1)-                   ;decrement word count if padded

_auto_60
        move    r1,y:<syncwrds          ;set the words per unpadded frame
        move    y:(r0)+,x0              ;get any unpadded frame extra bits
        move    x0,y:<syncbits          ;set any unpadded frame extra bits
        move    #0,r3                   ;to zero the failure counter
        move    r3,x:srchtries          ;zero the failure counter
        bclr    #0,y:<protect           ;start looking for CRC protection
        bclr    #0,y:privacybit         ;start looking for privacy bit off

_auto_70

;!!!BEN
;;;turn off the interrupt system
;;
;;      ori     #$03,mr

;initialize for the interrupt routine to try to frame

        move    x:srchtries,r3          ;current failuer counter
        move    #0,x0                   ;clear all bits
        move    (r3)+                   ;increment attempt ctr
        move    r3,x:srchtries          ;save incrment failure counter
        move    x0,y:<inpstat           ;flags to control i/p routine
;;      bset    #2,y:<inpstat           ;flag to do pad framing
;;      move    y:frmemod,a0            ;for framing buffer size
;;      move    a0,y:<inpsize           ;store for ssirec rtn to store
        move    #>AUTO_FRAMES,y1        ;# of frames to match
        move    y1,y:<syncfrms          ;set number of frames to sync
        move    x0,y:<synced            ;zero the synced frame counter
;;      move    #syncbuf,x0             ;address of the input buffer
;;      move    x0,y:<inpwptr           ;set the input write pointer

;!!!BEN
;;;before turning on the interrupts, restart the input data stream process
;;;  that inputs bits to form 24-bit words
```

```
;;
;;      move    #BitlT6In,r7            ;init the bit input buffer ptr
;;
;;      andi    #$fc,mr                 ;turn on the interrupt system
;;
;;;hang out here until framed or failed
;;
;;_auto_80
;;      bset    WATCH_DOG               ;tickle the dog
;;      bclr    WATCH_DOG               ;tickle the dog

        bset    #AUTONEXTFRAME,y:<process

;!!!BEN:perform old ssirec auto sampling on current frame

_auto_continue

;we are now attempting to frame:
;if start of "syncing" (bit 3 not set),
;   set 1st word of pair to check
;   set starting word offset
;   set flag to set 2nd word
;   continue to react when 2nd word to check comes in
;else,
;   see if waiting for the 2nd word or counting looking for the next sync

        move    y:frmcurr,r4            ;set start of the frame addr
        move    y:frmemod,m4            ;set circular buffer 2 frames

_auto_CC

;start looking for framing pattern

        jset    #3,y:<inpstat,_auto_35  ;we have set the 1st word, continue
        clr     a       r4,y:wrdoff     ;init for the 2 words to check
                                        ; & save initial start word offset
        move    x:(r4)+,a1              ;set 1st word to check (incr write ptr)
        bset    #3,y:<inpstat           ;flag to check the 2nd word
        move    #0,r2                   ;start count of words looking for sync
        jmp     _auto_CC                ;try 2nd word

;if waiting for 2nd word to check (bit 4 not set),
;   put new word in a0 to look for the 24 bit pattern
;   start the bit offset counter
;   loop through 24 bits over 1st and 2nd word trying to match one
;       of the defined sync patterns
;else,
;   we found a pattern and are trying sync up on the next frame

_auto_35
        jset    #4,y:<inpstat,_auto_105 ;counting to check next frame sync
        move    x:(r4),a0               ;set the 2nd word to search
        move    #0,r1                   ;init the bit offset counter
        do      #24,_auto_65

;see if current offset contains a valid sync pattern

        move    a1,b                    ;current bit offset pattern
        move    #syncptrn,n0            ;addr of array of sync patterns
        move    #0,r0                   ;offset to 1st pattern
```

```
;loop through the available sync patterns

        do      y:<synccnt,_auto_55
        move    y:(r0+n0),x0            ;get the next sync pattern to check
        cmp     x0,b                    ;see if pattern matches
        jne     _auto_45                ;if not, try next pattern

;we found a framing pattern, set the indication and break out to proceed

        bset    #4,y:<inpstat           ;indicate the match
        enddo                           ;end y:<synccnt loop
        enddo                           ;end #24 loop
        jmp     _auto_65                ;we matched the pattern

_auto_45

;try the next framing pattern

        move    (r0)+

_auto_55

;try the next bit for a match of a framing pattern

        asl     a       (r1)+           ;shift left into a1
                                        ; & increment the bit shift counter

_auto_65

;if the pattern was not matched,
;   set the next word as the offset
;   increment the address for the next word
;   exit the interrupt routine and wait for a new 2nd word to check

        clr     a       (r2)+           ;zero the sync'ed frames counter
                                        ;& incr count of words looking for sync
        jset    #4,y:<inpstat,_auto_75  ;if match, set up to check next frame
        move    y:<syncwrds,a           ;get number of words per frame
        move    #>FRAME_OVERAGE,x0      ;to add some cushion to frame length
        add     x0,a    r2,x0           ;add cushion to frame length
                                        ; & get words checked so far
        cmp     x0,a    r4,y:wrdoff     ;test more than frame checked for sync
                                        ; & save possible new start word offset

;if more than a full frame has been searched without finding SYNC:
;  we failed at framing at this sampling/bit rate

        jlt     _auto_155               ;indicate failure at sample/bit rate
        move    x:(r4)+,a1              ;set new 1st word to check (incr ptr)
        jmp     _auto_CC                ;try new 2nd word

_auto_75

;frame matches a sync pattern:
;   update the sync'ed frame counter
;   save the sync pattern match index to test for padding or not
;   store the new bit offset to start this frame
;   set the address and offset for the next frame
;   see if padding needed,
```

```
        move    a,y:<synced              ;update the sync'ed frame counter
        move    r0,y:<syncmtch           ;save matched pattern index
        move    r1,y:bitoff              ;save the bit offset
        move    y:wrdoff,r0              ;address start last frame
        move    y:frmemod,m0             ;set circular buffer
        move    y:<syncwrds,n0           ;words to next frame
        move    y:bitoff,a               ;get the bit offset start
        move    (r0)+n0                  ;address for next frame start
        move    y:<syncbits,x0           ;get unpadded frame extra bits
        add     x0,a    #>PAD_SLOT,x0    ;add extra bits to offset
                                         ; & set upo for any neede padding
        jclr    #0,y:<syncmtch,_auto_85  ;match index even, NOT padded
        add     x0,a                     ;add the padded bits

_auto_85

;see if bits exceeds full word and adjust

        move    #>24,x0                  ;24 bits per word
        cmp     x0,a                     ;see if next address needed
        jlt     _auto_95                 ;if offset within word, continue
        sub     x0,a    (r0)+            ;adjust the bit offset by full word
                                         ; & increment the start address

_auto_95

;set address and bit offset to match the next frame

        move    r0,y:wrdoff              ;start next frame word address
        move    a,y:bitoff               ;start next frame bit offset
;       move    (r4)+                    ;advance the write pointer
        move    y:linear,m4              ;restore as a linear buffer
        move    y:linear,m0              ;restore as a linear buffer
        bclr    #5,y:<inpstat            ;clear reached frame indicator
        rts                              ;BEN - exit rtn and wait for next frame

_auto_105

;if ready to check the new frame as it comes in
;    test if expected frame start address has been reached
;    if so, set indicator to check the next word received (2nd in the frame)
;        otherwise, keep accepting frame words into buffer
;else,
;    check for the pattern in the 1st and 2nd word (latest received)

        jset    #5,y:<inpstat,_auto_115
        move    r4,x0                    ;to test if frame start addr hit
        move    y:wrdoff,a               ;address to match
        cmp     x0,a    (r4)+            ;see if address hit
                                         ; & increment the write pointer
        jne     _auto_155                ;if not, frame length problem

;we have the 1st word of the frame
; set indicator to check 2nd word for framing pattern

        bset    #5,y:<inpstat            ;indicate check next word for pattern
;       jmp     _auto_CC                 ;to check 2nd word

_auto_115
```

```
;we now have the 2 words to check this frame for framing

        clr     a       #>1,x1          ;clear the register to align pattern
                                        ; & set to increment frame match count
        move    x:(r4)-,a0              ;retrieve 2nd word (back up to 1st)
        move    x:(r4)+,a1              ;retrieve 1st word (forward to 2nd)

;if a bit offset, shift over the expected bits to align the pattern

        move    y:bitoff,b              ;to see if a shift is needed
        tst     b                       ;see if zero
        jeq     _auto_125               ;if so, skip the shift

;shift left to align pattern in a1

        do      b,_auto_125
        asl     a

_auto_125

;see if current offset contains a valid sync pattern

        move    a1,b                    ;to test shifted pattern from frame
        move    #syncptrn,n0            ;addr of array of sync patterns
        move    #0,r0                   ;offset to 1st pattern
        bclr    #6,y:<inpstat           ;indicate no match yet

;loop through the available sync patterns

        do      y:<synccnt,_auto_145
        move    y:(r0+n0),x0            ;get the next sync pattern to check
        cmp     x0,b                    ;see if pattern matches
        jne     _auto_135               ;if not, try next pattern

;we found a framing pattern, set the indication and break out to proceed

        bset    #6,y:<inpstat           ;indicate the match
        enddo                           ;end y:<synccnt loop
        jmp     _auto_145               ;we matched the pattern

_auto_135

;try the next framing pattern

        move    (r0)+

_auto_145

;if not a match, we are not framed, try again via framit or autosmpl rtn

        jclr    #6,y:<inpstat,_auto_155

;we did match a framing pattern

        move    y:<synced,a             ;get count of frames sync'ed so far
        add     x1,a    y:<syncfrms,x1  ;increment count
                                        ; & set to test if limit reached
        cmp     x1,a    y:bitoff,r1     ;see if sync frame count reached
                                        ; & set the bit offset register
```

```
        jlt     _auto_75                    ;not at limit, go set up for next frame

;we are now considered framed
;   indicate OK
;   put bit offset for this new frame in proper register
;   put address offset for this new frame in proper register
;   set the data gathering correctly
;   exit the interrupt routine

        clr     a       #>1,x0              ;a=0 indicates we're framed
                                            ; & set to set flag to gather data
;;      move    y:bitoff,r3                 ;r3 is expected to have the bit offset
        move    y:wrdoff,b                  ;address of the last matched frame start
        move    #syncbuf,x1                 ;starting address of input buffer
        sub     x1,b    ;!!!BEN: (r4)+      ;calculate the start offset into buffer
                                ;!!!BEN     ; & increment the input write pointer
        move    b,y:wrdoff                  ;save buffer address start word offset
;;      move    b,r5                        ;r5 is expected to have address offset
        move    x0,y:<inpstat               ;set flag for normal data gathering
        jmp     _auto_160                   ;done with auto sample this sample rate

_auto_155

;failed to frame, indicate to the framit or autosmpl routine to try again

        bset    #8,y:<inpstat

_auto_160

;!!!BEN:perform old ssirec auto sampling on current frame

;;      jset    #0,y:<inpstat,_auto_90  ;framing found
        jset    #8,y:<inpstat,_auto_100 ;conclusion has been as not framed
;;      jmp     _auto_80                    ;continue waiting for result

;;_auto_90

;we have successfully framed the correct number of frames in a row
;  and therefore we found our sampling rate

;;!!!BEN enddo                              ;end #NUMSAMPLRATES loop
        bset    #AUTOSAMPLEPROCESS,y:<process   ;indicate auto sampling done
        clr     a                           ;indicate success to caller
        move    y:linear,m4                 ;restore as a linear buffer
        rts                                 ;return with sample rate found

_auto_100

;!!!BEN
;;;we did not frame at that last sample rate, try the next one
;;;turn off the interrupt system
;;
;;      ori     #$03,mr
;;      nop
;;      nop
;;      nop
;;      nop
;;      nop
        move    x:srchtries,x0              ;number of tries at sample rate
;;      move    r3,x0                       ;number of tries at sample rate
```



```
        move    #>MAX_AUTO_TRIES,a        ;get tolerance ctr
        cmp     x0,a                      ;see if time to try next sample rate
        jgt     _auto_70                  ;not yet make another try

;see if the pass looking for frames with privacy bit not set

        move    #privacybit,r3            ;addr of privacy bit flag
        nop
        jset    #0,y:(r3),_auto_108       ;if tried privacy, check protection

;now try looking for a frame header with the privacy bit set

        move    #syncptrn,r3              ;modify table of syn patterns
        bset    #0,y:privacybit           ;indicate privacy bit set

;for the number sync patterns set the privacy bit set

        do      y:<synccnt,_auto_102
        bset    #0,y:(r3)+

_auto_102

;restart the attempt counter for the new sync patterns

        move    #0,r3
        move    r0,x:srchtries            ;zero the failure counter
        jmp     _auto_70                  ;now make tries with privacy bit set

_auto_108

;see if the pass looking for frames without CRC protection was done
;  if so, try next sampling rate

        jset    #0,y:<protect,_auto_800 ;if no CRC done, try next sampling rate

;now try looking for a frame header without the CRC protection

        move    #syncptrn,r3              ;modify table of syn patterns
        bset    #0,y:<protect             ;indicate NO CRC protection
        bclr    #0,y:privacybit           ;reset try with privacy bit set to 0

;for the number sync patterns set the NO protection bit

        do      y:<synccnt,_auto_110
        bset    #8,y:(r3)                 ;set the protect bit
        bclr    #0,y:(r3)+                ;clear the privacy bit

_auto_110

;restart the attempt counter for the new sync patterns

        move    #0,r3
        move    r0,x:srchtries            ;zero the failure counter
        jmp     _auto_70                  ;now make tries without CRC bit

;7/12/94: added label to skip to next sampling rate if not applicable

_auto_800

;this sampling rate did not match, try the next table entry
```

```
;!!!BEN
;;      move    y:<svereg,r0            ;restore sample table address
;;      move    #AUTOBYSAMPLE,n0        ;set auto sample offset to next rate
;;      nop
;;      move    (r0)+n0                 ;advance to next sample rate

;!!!BEN:  increment the current sample rate table index to try next sample rate

        bclr    #AUTONEXTFRAME,y:<process       ;to start next sample rate entry
        move    x:srchrate,b            ;to increment table entry
        move    #>1,x0                  ;increment
        add     x0,b    #>NUMSAMPLERATES,x0     ;increment search index
                                        ; & get max table entries count
        cmp     x0,b    b,x:srchrate    ;see if table totally searched
                                        ; & in case, save new search index
        jlt     _auto_AA                ;if less than max, try new table entry

_auto_900

;we failed to determine the sampling rate, indicate failure to caller

        bset    #AUTOSAMPLEPROCESS,y:<process   ;indicate auto sampling done
        move    #>-1,a                  ;indicates failure
        move    y:linear,m4             ;restore as a linear buffer
        rts                             ;return to caller
```

```
        opt     fc
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\getancda.asm: BEN y:<linear, y:frmemod(inpsize)

; This routine decodes the ancillary data bytes for output to rs232 i/f.

; on entry
;       r6 = current offset in output array
;       y:dataiptr = address in data byte input buffer to start from
;       y:bytecnt = count of bytes in input buffer not yet transmitted

; on exit
;       a = destroyed
;       b = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r2 = destroyed
;       r3 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'
        include '..\common\ioequ.asm'
        include 'box_ctl.asm'

        section bytebuffer
        xdef    databytes

        org     yli:
stgetancda_yli

databytes       ds      DATABUFLEN      ;buffer for bytes received

endgetancda_yli
        endsec

        section highmisc
        xdef    anctype
        xdef    baudrte                 ;data baud rate code from switches
        xdef    dataiptr
        xdef    dataoptr
        xdef    bytecnt
        xdef    maxbytes
        xdef    savea0
        xdef    savea1
        xdef    savea2
        xdef    padbytes

        org     yhe:
stgetancda_yhe

anctype         ds      1       ;type of count field after audio data:
                                ;       0 = 3 bit padded byte count
                                ;       1 = 8 bit data byte count
baudrte         ds      1       ;data baud rate code from switches
dataiptr        ds      1       ;ptr for next byte decoded from frame
```

```
dataoptr        ds      1       ;ptr for next byte to transmitted to rs232
bytecnt         ds      1       ;count of bytes yet to be output to rs232
maxbytes        ds      1       ;tolerance check of bytecnt for scixmt
savea0          ds      1       ;save reg a0 for scixmt
savea1          ds      1       ;save reg a1 for scixmt
savea2          ds      1       ;save reg a2 for scixmt
padbytes        ds      1       ;hold pad bytes from the frame

endgetancda_yhe
        endsec

        org     phe:

getancdata

;clear the ancillary data problem for old CCS frames

        bclr    #2,y:oldccs

;set address of type of count to extract:
;       padded bits byte count OR data byte count

        move    #anctype,r4             ;addr of type of count field

;do not decode ancillary data from a reused saved frame

        jset    #USE_SAVED,y:<ctlflgs,_ancd_90 ;if not reused, continue

;see if data byte count, and if so, read byte count and then bytes

        jset    #0,y:(r4),_ancd_78      ;if byte count, get data byte count

;set the end of the MUSICAM portion of the full frame values

        move    y:frendwd,r0            ;normal MUSICAM frame last word address
        move    y:frendbt,n0            ;normal MUSICAM frame last bit offset
        move    y:frmemod,m0            ;set circular buff to addj addr
        move    m0,m1                   ;set circular buff to addj addr
        move    #>-1,x0                 ;init the pad bytes value
        move    x0,y:padbytes

;test if room remaining in the frame to read the CCS ancillary data pad
;  byte count

        move    r0,r1                   ;get addr of last word into proper reg
        move    r6,a                    ;to test next addr to decode
        move    (r1)+                   ;to see if last word being decoded
        move    r1,x0                   ;to test last frame word address
        cmp     x0,a    #>BITSFORPADDING,x1     ;see if about to decode last
                                        ; & set numb bits in pad byte cnt
        jne     _ancd_00                ;if not, test room from curr decode word

;decoding of the last word in the frame is in progress,
;  see if sufficient bits remain to get the padded byte count

        move    #>24,b                  ;get bits per word
        move    y:<sc,x0                ;get undecoded bits count in last word
        sub     x0,b    n0,x0           ;calc bits decoded from last word so far
                                        ; & get total bits in that last word
        neg     b                       ;make bits already decoded negative
```

```
        add     x0,b                    ;add total bits in last word
        cmp     x1,b                    ;see if enough bits remain
;!!!dbg jlt     _ancd_85                ;if not it's not CCS, no ancillary data
        jge     _ancd_05                ;if so, do ancillary data
        nop
        nop
        nop
        nop
        nop
        jmp     _ancd_85                ;if not it's not CCS, no ancillary data

_ancd_00

;test the next to last word address to test remaining bits - offset to last

        move    (r1)-                   ;back up to next to last word addr
        move    r1,x0                   ;to test next to last vs next addr
        cmp     x0,a                    ;see if next is next to last
        jne     _ancd_05                ;if not at next to last, do ancillary

;see if remaining bits in current (next to last) word being decoded
;  plus the number of bits in the last word have enough bits for pad byte cnt

        move    y:<sc,b                 ;get undecoded bit cnt curr decode word
        move    n0,x0                   ;get total bits in that last word
        add     x0,b                    ;add total bits to remaining bits cnt
        cmp     x1,b                    ;see if enough bits left in the frame
;!!!dbg jlt     _ancd_85                ;if not, it's not CCS no ancillary data
        jge     _ancd_05                ;if so, do ancillary data
        nop
        nop
        nop
        nop
        nop
        jmp     _ancd_85                ;if not, it's not CCS no ancillary data

_ancd_05

;get the count of pad audio bytes from the frame

        move    #masktbl,r2
        move    #BITSFORPADDING,n4      ;numb bits in pad byte count
        move    n4,n2                   ;get hi order bit mask index
        jsr     getvalue                ;get pad byte count from frame
        move    y:(r2+n2),x1            ;mask off high order one's
        and     x1,a      n0,x0         ;mask off high order one's
                                        ; & set end of frame bit offset

        move    a1,a                    ;clean up for a zero test
        move    a,y:padbytes            ;save the retrieved pad byte count
        tst     a         y:dataiptr,r5 ;test if any pad bytes included
                                        ; & set addr of next byte to be stored
        jeq     _ancd_40                ;no pad bytes in frame, go decode data

;adjust end of frame for padded bytes (8 bits per byte)

        move    #>8,x1                  ;set up bits in a data byte
        move    a1,y1                   ;get count of pad bytes
        mpy     x1,y1,a #>24,x1         ;mult by 8 bits per byte
                                        ; & set bits per word
```


BAD ORIGINAL

```
        asr     a         r6,b              ;align integer result
                                            ; & get next decoded word addr
        move    a0,a                        ;shift integer result

_ancd_10
        cmp     x1,a                        ;if a full word of padding remains
        jlt     _ancd_20                    ;if not, go adjust the bit offset
        move    r0,y0                       ;to see if at next decode word
        cmp     y0,b                        ;see if next to decode reached
;!!!dbg jeq     _ancd_89                    ;if so, no data to decode
        jne     _ancd_15                    ;if not, keep checking
        nop
        nop
        nop
        nop
        nop
        jmp     _ancd_89                    ;if so, no data to decode

_ancd_15
        sub     x1,a      (r0)-             ;sub full 24 bits,
                                            ; & back off one word in end address
        jmp     _ancd_10                    ;try again

_ancd_20

;now back off the number of bits

        cmp     x0,a      x0,b              ;offset vs rest of pad bits
                                            ; & offset to b reg for adjustment
        jle     _ancd_30                    ;if less or equal, don't adjust
        move    r6,b                        ;get next decoded word addr
        cmp     y0,b      x0,b              ;see if next to decode reached
                                            ; & offset to b reg for adjustment
;!!!dbg jeq     _ancd_89                    ;if so,no data to decode
        jne     _ancd_25                    ;if not, data to decode
        nop
        nop
        nop
        nop
        nop
        jmp     _ancd_89                    ;if so, no data to decode

_ancd_25
        add     x1,b      (r0)-             ;adjust offset by bits for full word
                                            ; & back off one more word address
_ancd_30

;adjust the bit offset by the remaining pad bits

        move    a,x0                        ;get the remaining pad bits
        sub     x0,b                        ;calculate new bit offset
        move    b,n0                        ;save approx end of anc data offset

_ancd_40

;now get the bytes and store in the buffer for the trasmit interrupt

        move    #DATABUFLEN-1,m5            ;circular buffer
        move    #BITSPERBYTE,n4             ;number of bits to decode from frame
        move    n4,n2                       ;get hi order bit mask index
```

BAD ORIGINAL

```
        move    #0,r3                   ;this is the decoded byte counter

_ancd_50

;as long as there is room for a byte to be decoded, do it

        move    r6,r1                   ;curr next frame word address
        move    #>BITSPERBYTE,x1        ;set up bits in a data byte
        move    (r1)-                   ;next frame word addr - 1 = curr addr
        move    r0,a                    ;get frame end word addr
        move    n0,y0                   ;get end bit offset in frame end word
        move    r1,x0                   ;to compare curr frame word to end addr
        cmp     x0,a    y:<sc,b         ;is curr frame word equal end frame word
                                        ; & get bit offset into curr frame word
        jne     _ancd_60                ;if not end frame word, try next to last

;since we've decoded into the last word in the frame,
; subtract remaining bit in curr word from 24 to determine how many have
;       been decoded
; subtract the used bits from the last word bits available

        move    #>24,a                  ;bits per word to be sub from
        sub     b,a     y0,b            ;subtract y:<sc from 24 to get used cnt
                                        ; & get last word bits available
        sub     a,b                     ;sub used bit cnt from bits abvalable
        jmp     _ancd_70                ;see if another byte can be decoded

_ancd_60

;since we have not reached the last frame word, we must see if we're at
; the next to last frame, and if not, keep decoding ancillary data bytes

        move    r0,r1                   ;end frame word address
        nop                             ;this pains me
        move    (r1)-                   ;back up to next to last addr
        move    r1,a                    ;for comparison
        cmp     x0,a                    ;is curr frame word = end - 1 frame word
        jne     _ancd_75                ;if not, decode the next data byte

;we have reached the next to last frame word,
; add bits from the last frame word to those remaining in this byte
; if there is a byte's worth of bits, decode another ancillary data byte

        add     y0,b                    ;add number of bits in last word

_ancd_70

        cmp     x1,b                    ;see if a byte fits in the bits left
        jlt     _ancd_80                ;no more bytes, go update byte count

_ancd_75

;there is room for another byte, let's get it

        jsr     getvalue                ;retreive the next byte from the frame
        move    y:(r2+n2),x1            ;mask off high order one's
        and     x1,a    (r3)+           ;mask off high order one's
                                        ; & incr byte counter

;insert the byte into the transmit buffer
```


BAD ORIGINAL

```
        move    a1,y:(r5)+              ;put the byte out

;test to see that did not exceed baud rate byte count

        move    r3,y0                   ;count of data bytes just decoded
        move    y:maxbytes,a            ;maxbytes tolerance decoded check
        cmp     y0,a                    ;check for frame alignment error
        jlt     _ancd_85                ;skip if too many bytes decoded
        jmp     _ancd_50                ;see if there is room for another

_ancd_78

;get the count of ancillary data bytes in the frame

        move    #BITSPERBYTE,n4         ;bits in the ancillary data byte count
        move    #masktbl,r2             ;set addr of the masking table
        move    n4,n2                   ;get hi order bit mask index
        jsr     getvalue                ;get pad byte count from frame
        move    y:(r2+n2),x1            ;get mask off high order one's
        and     x1,a      #0,r3         ;mask off high order one's
                                        ; & zero decoded byte counter
        move    a1,a                    ;clean up for a zero test
        tst     a         y:dataiptr,r5 ;test if any data bytes included
                                        ; & set addr of next byte to be stored
        jeq     _ancd_90                ;no data bytes in frame, we're done

;make sure the data byte count is valid vs the max bytes at this baud rate

        move    y:maxbytes,x0           ;get max bytes @ baud rate
        cmp     x0,a                    ;comp byte count from frame to max
        jgt     _ancd_85                ;if number is too big, skip data

;now get the bytes and store in the buffer for the trasmit interrupt

        move    #DATABUFLEN-1,m5        ;set circular buffer

;get the count of ancillary data bytes in the frame
; bytes are stored in the reverse order received by encoder

        do      a,_ancd_80

;get the next ancillary data byte

        jsr     getvalue                ;retreive the next byte from the frame
        move    y:(r2+n2),x1            ;mask off high order one's
        and     x1,a      (r3)+         ;mask off high order one's
                                        ; & incr byte counter

;insert the byte into the transmit buffer

        move    a1,y:(r5)+              ;put the byte out

_ancd_80

;temporarily disable the interrupt for data received

        bclr    #M_TIE,x:<<M_SCR
        nop
        nop
```

BAD ORIGINAL

```
        nop

;while waiting for interrupt to take effect:
;   make a tolerance check of the frame's alignment to make sure
;   we haven't decoded more data bytes than is possible
; if we have decoded too many bytes,
;   skip the junk just decoded by ignoring the results of this frame

        move    r3,y0                       ;count of data bytes just decoded
        move    y:maxbytes,a                ;maxbytes tolerance decoded check
        cmp     y0,a    y:bytecnt,a         ;check for frame alignment error
                                            ; & get latest byte cnt of unsent bytes
        jlt     _ancd_85                    ;skip if too many bytes decoded

;interrupt should now be disabled and we can safely update count of unsent bytes

        add     y0,a    r5,y:dataiptr       ;add count of bytes just framed
                                            ; & save addr of next byte next frame
        move    a,y:bytecnt                 ;save new unsent byte count
        jmp     _ancd_89                    ;reset interrupt

_ancd_85

;a problem decoding ancillary data may indicate a stream of frames from
;    some other manufacturer
;  or,
;    if the frames are from a CCS encoder that is encoding old CCS CDQ2000
;       two-channel frames at a low bit rate that is incorrectly using
;       the wrong allowed table BUT, has an old CCS CRC-16 checksum

;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        jset    #CRC_OLD_vs_NEW,y:<ctlflgs,_ancd_89     ;if ISO CRC, continue
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        bset    #2,y:oldccs                 ;show problem to switch to old CCS

_ancd_89

;turn the transmit byte interrupt back on

        bset    #M_TIE,x:<<M_SCR                    ;enable transmit interrupt

;return after all bytes decoded and counted

        move    y:linear,m0                 ;uncircular buffer
        move    m0,m1                       ;uncircular buffer
        move    m0,m5                       ;uncircular buffer

_ancd_90
```

rts

```
        opt     fc
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\getbal.asm: BEN y:<frmtype y:<sibound

        title   'Get bit allocations'

; This routine is used to get the bit allocations of each of the sub-bands.
;
; It is from the ISO standard.
; sub-band  0 - 10 use 4 bits (11 * 4 = 44 bits)
; sub-band 11 - 22 use 3 bits (12 * 3 = 36 bits)
; sub-band 23 - 26 use 2 bits ( 4 * 2 =  8 bits)
;                             ( total = 88 bits)

; on entry
;       r0 = address of bit allocation array for both left and right channels
;
;       r6 = current offset in the input array
;       n6 = base address of the input array
;       y:<maxsubs = MAXSUBBANDS at sampling rate and bit rate
;       y:sc = shift count of current input word
;       y:frmtype = full stereo, joint stereo or mono
;       y:sibound = joint stereo sub-band intensity bound
;       x:crcbits = accumulator of bits covered by CRC-16 routine
;                   (bit allocation bits are accumulated)
;
; on exit
;       r6 = updated
;       y:sc = updated
;
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r2 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'

        section highmisc
        xdef    masktbl
        xdef    tbl

        org     yhe:
stgetbal_yhe

masktbl
        dc      $000000         ;place holder in mask table
        dc      $000001         ;mask table for 1 bit getvalue
        dc      $000003         ;mask table for 2 bit getvalue
        dc      $000007         ;mask table for 3 bit getvalue
        dc      $00000f         ;mask table for 4 bit getvalue
        dc      $00001f         ;mask table for 5 bit getvalue
```

```
        dc      $00003f                 ;mask table for 6 bit getvalue
        dc      $00007f                 ;mask table for 7 bit getvalue
        dc      $0000ff                 ;mask table for 8 bit getvalue
        dc      $0001ff                 ;mask table for 9 bit getvalue
        dc      $0003ff                 ;mask table for 10 bit getvalue
        dc      $0007ff                 ;mask table for 11 bit getvalue
        dc      $000fff                 ;mask table for 12 bit getvalue
        dc      $001fff                 ;mask table for 13 bit getvalue
        dc      $003fff                 ;mask table for 14 bit getvalue
        dc      $007fff                 ;mask table for 15 bit getvalue
        dc      $00ffff                 ;mask table for 16 bit getvalue
        dc      $01ffff                 ;mask table for 17 bit getvalue
        dc      $03ffff                 ;mask table for 18 bit getvalue
        dc      $07ffff                 ;mask table for 19 bit getvalue
        dc      $0fffff                 ;mask table for 20 bit getvalue
        dc      $1fffff                 ;mask table for 21 bit getvalue
        dc      $3fffff                 ;mask table for 22 bit getvalue
        dc      $7fffff                 ;mask table for 23 bit getvalue
        dc      $ffffff                 ;mask table for 24 bit getvalue

;define data size table for the getvalue routine to extract data

tbl
        dc      $000000                         ;bits =  0, place holder
        dc      $000001                         ;shift left 01 bits
        dc      $000002                         ;shift left 02 bits
        dc      $000004                         ;shift left 03 bits
        dc      $000008                         ;shift left 04 bits
        dc      $000010                         ;shift left 05 bits
        dc      $000020                         ;shift left 06 bits
        dc      $000040                         ;shift left 07 bits
        dc      $000080                         ;shift left 08 bits
        dc      $000100                         ;shift left 09 bits
        dc      $000200                         ;shift left 10 bits
        dc      $000400                         ;shift left 11 bits
        dc      $000800                         ;shift left 12 bits
        dc      $001000                         ;shift left 13 bits
        dc      $002000                         ;shift left 14 bits
        dc      $004000                         ;shift left 15 bits
        dc      $008000                         ;shift left 16 bits
        dc      $010000                         ;shift left 17 bits
        dc      $020000                         ;shift left 18 bits
        dc      $040000                         ;shift left 19 bits
        dc      $080000                         ;shift left 20 bits
        dc      $100000                         ;shift left 21 bits
        dc      $200000                         ;shift left 22 bits
        dc      $400000                         ;shift left 23 bits
        dc      $800000                         ;shift left 24 bits

endgetbal_yhe
        endsec

        section highmisc
        xdef    skftbl
        xdef    skftbl_1
        xdef    skftbl_2
        xdef    skftbl_3

        org     xhe:
stgetbal_xhe
```

```
;address of BAL's bit table as per Allowed table selected

skftbl  ds      1

;These tables is the number of bits used by the scale factor in each sub-band

; High sampling rates with higher bit rate framing

skftbl_1
        dc      4               ;sub-band 0
        dc      4               ;sub-band 1
        dc      4               ;sub-band 2
        dc      4               ;sub-band 3
        dc      4               ;sub-band 4
        dc      4               ;sub-band 5
        dc      4               ;sub-band 6
        dc      4               ;sub-band 7
        dc      4               ;sub-band 8
        dc      4               ;sub-band 9
        dc      4               ;sub-band 10

        dc      3               ;sub-band 11
        dc      3               ;sub-band 12
        dc      3               ;sub-band 13
        dc      3               ;sub-band 14
        dc      3               ;sub-band 15
        dc      3               ;sub-band 16
        dc      3               ;sub-band 17
        dc      3               ;sub-band 18
        dc      3               ;sub-band 19
        dc      3               ;sub-band 20
        dc      3               ;sub-band 21
        dc      3               ;sub-band 22

        dc      2               ;sub-band 23
        dc      2               ;sub-band 24
        dc      2               ;sub-band 25
        dc      2               ;sub-band 26
;end table 3-B.2a
        dc      2               ;sub-band 27
        dc      2               ;sub-band 28
        dc      2               ;sub-band 29
;end table 3-B.2b
        dc      2               ;sub-band 30
        dc      2               ;sub-band 31

; High sampling rates with lower bit rate framing

skftbl_2
        dc      4               ;sub-band 0
        dc      4               ;sub-band 1

        dc      3               ;sub-band 2
        dc      3               ;sub-band 3
        dc      3               ;sub-band 4
        dc      3               ;sub-band 5
        dc      3               ;sub-band 6
        dc      3               ;sub-band 7
```

```
;end table 3-B.2c
        dc      3               ;sub-band 8
        dc      3               ;sub-band 9
        dc      3               ;sub-band 10
        dc      3               ;sub-band 11
;end table 3-B.2d
        dc      3               ;sub-band 12
        dc      3               ;sub-band 13
        dc      3               ;sub-band 14
        dc      3               ;sub-band 15
        dc      3               ;sub-band 16
        dc      3               ;sub-band 17
        dc      3               ;sub-band 18
        dc      3               ;sub-band 19
        dc      3               ;sub-band 20
        dc      3               ;sub-band 21
        dc      3               ;sub-band 22
        dc      3               ;sub-band 23
        dc      3               ;sub-band 24
        dc      3               ;sub-band 25
        dc      3               ;sub-band 26
        dc      3               ;sub-band 27
        dc      3               ;sub-band 28
        dc      3               ;sub-band 29
        dc      3               ;sub-band 30
        dc      3               ;sub-band 31

; Low sampling rates

skftbl_3
        dc      4               ;sub-band 0
        dc      4               ;sub-band 1
        dc      4               ;sub-band 2
        dc      4               ;sub-band 3

        dc      3               ;sub-band 4
        dc      3               ;sub-band 5
        dc      3               ;sub-band 6
        dc      3               ;sub-band 7
        dc      3               ;sub-band 8
        dc      3               ;sub-band 9
        dc      3               ;sub-band 10

        dc      2               ;sub-band 11
        dc      2               ;sub-band 12
        dc      2               ;sub-band 13
        dc      2               ;sub-band 14
        dc      2               ;sub-band 15
        dc      2               ;sub-band 16
        dc      2               ;sub-band 17
        dc      2               ;sub-band 18
        dc      2               ;sub-band 19
        dc      2               ;sub-band 20
        dc      2               ;sub-band 21
        dc      2               ;sub-band 22
        dc      2               ;sub-band 23
        dc      2               ;sub-band 24
        dc      2               ;sub-band 25
        dc      2               ;sub-band 26
        dc      2               ;sub-band 27
```

```
        dc      2                   ;sub-band 28
        dc      2                   ;sub-band 29
;end table 3-B.1
        dc      2                   ;sub-band 30
        dc      2                   ;sub-band 31

endgetbal_xhe
        endsec

        org     phe:

;initialize:
;  a. r1 with start of subband allocation table of bits in frame per sub-band
;  b. n0 offset for right channel sub-band bit allocation values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;  c. r3 set with joint stereo sub-band boundary for stereo intensity:
;       4 (4-31), 8 (8-31), 12 (12-31) or 16 (16-31)
;
getbal
        move    x:skftbl,r1
        move    #masktbl,r2
        move    #NUMSUBBANDS,n0         ;offset for right channel
        move    y:sibound,r3            ;decr stereo intens sub-band ctr
        move    x:crcbits,r5            ;get CRC-16 bit counter

;
;loop through the sub-bands extracting the left and right (if applicable)
;bit allocation index values (y:<maxsubs = fixed count of sub-bands framed):
; a. for current sub-band get the number of bits for allocation index value
;    and increment address of the next sub-band bit count
; b. get the bit allocation for the left channel always
; c. b register isolate the type of frame: full stereo, joint stereo or mono
; d. y0 holds the mono frame type code for testing
; e. y1 holds the joint stereo frame type code for testing
; f. see if the frame type is joint stereo and just in case, move the
;    current stereo intensity sub-band boundary counter value for testing
; g. if not joint stereo, see if this is a mono frame type
; h. if it is joint stereo:
;    1. test if the boundary counter has reached zero, and just in case it has,
;       restore the left channel bit allocation value to the a1 register
;    2. if the counter is zero, go to copy left channel into the right channel
;    3. if not, go to extract the full stereo right channel allocation value
;
        do      y:<maxsubs,_getb_40
        move    x:(r1)+,n4                      ;get # of bits to read
        move    n4,n2                           ;get hi order bit mask index
        move    n4,n5                           ;to accumulate CRC-16 bits
        jsr     getvalue                        ;get a left chan bit allocation
        move    y:(r2+n2),x1                    ;mask for high order one's
        move    (r5)+n5                         ;accum bits for CRC-16 rtn
        and     x1,a        y:frmtype,b         ;mask off high order one's
                                                ; & set for frame type compare
        move    a1,x:(r0)                       ;set left channel
        move    #>MONO,y0                       ;ck for no right channel
        move    #>JOINT_STEREO,y1               ;ck for intensity sub-band
        cmp     y1,b        r3,a                ;check for stereo intensity
        jne     _getb_10                        ;if not, see if mono
        tst     a           x:(r0),a1           ;reached bound, restore left val
        jeq     _getb_30                        ;yes, left val to right val
        move    (r3)-                           ;no, decr intens sub-band cntr
```

```
        jmp     _getb_20                        ; and retreive right chan value
;
;test for a mono type of frame and just in case it is, set a1 to zero
;  for insertion into the right channel for consistency
;if it is mono, go to move the right channel value
; otherwise, fall through to full stereo
;
_getb_10
        cmp     y0,b    #0,a1                   ;if mono, insert 0 for right
        jeq     _getb_30
;
;full stereo, extract the right channel bit allocation value
;
_getb_20
        jsr     getvalue                        ;get a right chan bit allocation
        move    y:(r2+n2),x1                    ;mask for high order one's
        move    (r5)+n5                         ;accum bits for CRC-16 rtn
        and     x1,a                            ;mask off high order one's
;
;insert the right channel value (n0 offset)
;increment for the next sub-band
;
_getb_30
        move    a1,x:(r0+n0)                    ;right channel sub-band alloc
        move    (r0)+                           ;incr for next sub-band

_getb_40
;
; Fill the unused sub-bands with 0 bit allocation
; This allows getdata to process these sub-bands normally and insert 0
; data in them.
;
        clr     a       #>NUMSUBBANDS,b
        move    y:<maxsubs,x0                   ;current MAXSUBBANDS
        sub     x0,b                            ;equals unused sub-bands
        do      b,_getb_50
        move    a,x:(r0+n0)                     ;right channel
        move    a,x:(r0)+                       ;left chan & incr for next

_getb_50
        move    r5,x:crcbits            ;store updated CRC-16 bit counter

        rts
```


BAD ORIGINAL

```
        opt     fc,mex
;
; (c) 1995. Copyright Corporate Computer Systems. Inc. All rights reserved.
;
; \DGCST\rmicrmus.asm: with Reed Solomon decoding
;
        title   'Main'
;
; 27/4/93: rmicrmus.asm version of cdq2000 MUSICAM (rdcdsynt.asm) for micro
;
;************************************************************
;************************************************************
;
; 08/26/91: (dsb & lwh)
;
; NOTE: Never use m4 to control a circular buffer. The interrupt routine.
;       ssirec.asm has been sped up by using m4 and then restoring it
;       to a linear buffer.
;
;************************************************************
;************************************************************
;
; This routine does it all for the decoder.

        include 'def.asm'
        include '..\common\ioequ.asm'
        include 'box_ctl.asm'

        section highmisc
        xdef    SBndSKF
        xdef    ASMData                         ;set A of 192 inverse quantized l&r

        org     xhe:
strmicro_xhe

SBndSKF ds      NUMSUBBANDS*NPERGROUP*2 ;left & right sub-band scale factors
ASMData ds      NUMSUBBANDS*NPERGROUP*2 ;192 samples per 1 group of 3 samples
                                        ;   for 32 sub-bands from both channels

endrmicro_xhe
        endsec

        section highmisc
        xdef    chcksum
        xdef    frmsize
        xdef    frmemod
        xdef    frmhalf
        xdef    framesz
        xdef    oof
        xdef    voof
        xdef    poof
        xdef    doof
        xdef    IPwrdoff
        xdef    IPbitoff
        xdef    wrdoff
        xdef    bitoff
        xdef    dcdfrmod
        xdef    sveidbit
        xdef    sverate
```

```
        xdef    svesmpl
        xdef    smplcde
        xdef    bitrate
        xdef    inpaddr
        xdef    frmrate
        xdef    smplrte
        xdef    iputcde
        xdef    smplidbit
        xdef    maxsubs_1
        xdef    maxsubs_2
        xdef    oldccs
        xdef    biterrs
        xdef    fade
        xdef    fadecnt
        xdef    frtries
        xdef    samping,bitrates,baudclk

        org     yhe:
strmicro_yhe

chcksum ds      1                       ;hold checksum from coded frame
frmsize ds      1                       ;number of words in a frame
frmemod ds      1                       ;numb words in 2 frames - 1 (mod buffer)
frmhalf ds      1                       ;1/2 words in framed buf (rd ptr check)
framesz ds      1                       ;size of framing input mod buffer ctl
;successive framing faults:
;       oof  = out-of-frame  sync pattern failures
;       vocf = sample rate code faults (auto sample vs frame header
;       pocf = CRC protection code faults (auto sample vs frame header)
;       doof = ancillary data errors coupled with old CCS CRC-16 algorithm
oof     ds      1               ;out-of-frame faults: numb of oof's (0-NOOF)
vocf    ds      1               ;number of voof's (0-NOOF)
poof    ds      1               ;CRC protection faults: numb of poof's (0-NOOF)
doof    ds      1               ;ancil data with old CCS CRC-16: docf's (0-NOOF)
IPwrdoff        ds      1       ;frame i/p word offset from start of buffer
IPbitoff        ds      1       ;frame i/p bit offset from msb
wrdoff          dc      0       ;frame decoding word offset from start of buffer
bitoff          dc      0       ;frame decoding bit offset from msb
dcdfrmod        ds      1       ;framebuf circ buf mod ctl

;these are for auto detect as requested by switches

sveidbit        ds      1       ;ISO sampling id bit from frame header: low/high
sverate         ds      1       ;ISO bit rate from frame header: lo/hi Kbit rate
svesmpl         ds      1       ;ISO sampling rate from frame header: low/high
smplcde         ds      1       ;ISO sampling rate from on select sws: low/high
bitrate         ds      1       ;ISO bit rate from select sws: lo/hi Kbit rate

inpaddr ds      1                       ;hold i/p buf addr to restore after save
frmrate dc      0                       ;dip switch (1 bit) indicate  which
                                        ; of 2 selectable bit rates
                                        ; bit rate sets numb words in a frame:
                                        ;       0 = lower Kbit rate
                                        ;       1 = higher Kbit rate
smplrte dc      0                       ;i/p PCM data sampling rate
iputcde dc      0                       ;0 = MUSCIMAM frames, 1 = G722 data i/p
smplidbit       dc      0               ;ISO hdr id bit:
                                        ;       1 = 32 or 48 K sampling rate
                                        ;       0 = 16 or 24 K sampling rate
maxsubs_1       ds      1               ;MAXSUBBANDS if MONO frames
```

```
maxsubs_2       ds      1               ;MAXSUBBANDS if 2 channel frames
oldccs          ds      1               ;bit 0 = 1 to decode old CCS CDQ1000
                                        ;       0 means MPEG-ISO frames
biterrs ds      1                       ;count successive bit errors
fade    ds      1                       ;in case of fade volume output ctl
fadecnt ds      1                       ;in case of fade volume output ctl
frtries dc      0                       ;count framing to reboot if too many

        SAMPLERATES             ;table of sample rate variables

        BITRATES                ;table of framing bit rate variables

        BAUDCLK                 ;table of specified ancillary data rates

endrmicro_yhe
        endsec

;
;The variables below are defined in lowmisc in low y memory and must be located
;       below address 40 to make use of short addressing.
;

        section lowmisc
        xdef    word_out,word_in,not_appl
        xdef    frmtype
        xdef    sibound
        xdef    ctlflgs
        xdef    maxsubs
        xdef    protect
        xdef    inpstat
        xdef    inpsize
        xdef    temp
        xdef    olwptr,orwptr
        xdef    linear

        org     yli:
strmicro_yli

word_out        ds      1       ;applicable hardware outputs (leds, switches)
word_in         ds      1       ;applicable hardware inputs (switches, lines)
not_appl        ds      1       ;satisfy non-applicable hardware settings
frmtype ds      1                       ;from coded frame indicates:
                                        ;       00 = (0) full stereo
                                        ;       01 = (1) joint stereo
                                        ;       10 = (2) dual channel
                                        ;       11 = (3) mono (1 channel)
sibound ds      1                       ;intensity subband boundary alloc addr
ctlflgs ds      1                       ;control indicators in certain bits:
                                        ; bit 0 = STEREO_vs_MONO:
                                        ;       0 = stereo
                                        ;       1 = mono
                                        ; bit 2 = joint stereo or not
                                        ;       0 = NOT joint
                                        ;       1 = joint stereo frame
                                        ;bits 6, 7 and 8 indicate protection
                                        ;was a saved frame used 0=no, 1=yes
                                        ; bit 6 is overwritten when validating
                                        ;  the checksum after getsbits:
                                        ;    if 0 = checksum valid,
                                        ;       use the frame in progress
```


BAD ORIGINAL

```
                                        ;     and save it when finished
                                        ;   if 1 = checksum failed,
                                        ;     use previous saved frame
                                        ;     and bypass saving it when done
                                        ; bit 7 indicates if a saved frame
                                        ;   has been stored:
                                        ;     0 = no saved frame
                                        ;     1 = yes a saved frame
                                        ; bit 8 indicates to getvalue this
                                        ;   is a good frame to store:
                                        ;     0 = do not store in save area
                                        ;     1 = do store in save area
                                        ; bit 18 indicates whether the frame
                                        ;   is coded with CRC protection or not
                                        ;     0 = no CRC16 checksum
                                        ;     1 = yes CRC16 checksum included
                                        ; bit 19 is for mono output only when
                                        ;   one channel is used for output and
                                        ;   the other is to be muted
                                        ;   (see bit 20):
                                        ;     0 = left channel for output
                                        ;     1 = right channel for output
                                        ; bit 20 is for mono output only and
                                        ;   specifies if the mono is to output
                                        ;   to one or both channels:
                                        ;     0 = both channels
                                        ;     1 = one channel only
                                        ;           as defined by bit 19
maxsubs ds      1                       ;working MAXSUBBANDS
protect ds      1                       ;flag for CRC checksum protection:
                                        ;     bit 0: 0 = yes, 1 = no
inpstat ds      1                       ;state of data collection
inpsize ds      1                       ;used by ssirec to set mod buffer i/p
temp    ds      1                       ;use by ssixmte for temp storage
olwptr  ds      1                       ;output left write pointer
orwptr  ds      1                       ;output right write pointer
linear  ds      1                       ;value -1 to reset regs to linear buffs

endrmicro_yli
        endsec

        org     phe:

start

;turn off the interrupt system

        ori     #$03,mr
        nop
        nop
        nop

        movep   #$0001,x:<<M_BCR        ;set all external io wait states

;set dsp56002 clock to selected MHz (PLL Control Register)

        RDECODE_M_PCTL

;       jsr     <initdeb                ;init the debug port
;       move    #$720906,a
```

```
;       jsr     <outhex
;       jsr     <cr

;initialize the volume output fade control

;FD     clr     a
;FD     move    a,y:fade
;FD     move    a,y:fadecnt

;  PORT C Assignments
;
;  s = ssi port
;  i = input port
;  o = output port
;
;  8 - 7 6 5 4 - 3 2 1 0
;  s   s s s s   s i s s

        RDECODE_PORT_C_M_PCC    ;set C control register for general IO
        RDECODE_PORT_C_M_PCD    ;set the default outputs
        RDECODE_PORT_C_M_PCDDR  ;set C register direction

; initialize the ssi port for the input from the xmitter

        RDECODE_SSI_M_CRA       ;set ssi cra register
        RDECODE_SSI_M_CRB       ;set ssi crb register

; initialize the sci port for tty

        RDECODE_SCI_M_SCR       ;set sci status control register

;  PORT B Assignments
;
;  i = input port
;  o = output port
;
; 14 13 12 - 11 10 9 8 - 7 6 5 4 - 3 2 1 0
;  o  o  o    o  o o o   o i i i   i i i i

        RDECODE_PORT_B_M_PBC    ;set B control register for general IO
        RDECODE_PORT_B_M_PBD    ;set the default outputs
        RDECODE_PORT_B_M_PBDDR  ;set B register direction

        move    #>ON_LEDS_DCD,b             ;flash the LEDS on
        move    b,y:<word_out
        CLR_DAC_RESET                       ;clear the DAC reset line to mute output
        ON_LO_SAMPLE_RATE_LED_DCD
        ON_HI_SAMPLE_RATE_LED_DCD
        SET_LEDS_DCD
        INTERRUPT_HOST_DCD
        move    #>RDCDSYNT_STARTUP,a
        jsr     <wait

;initialize the linear buffer value for mX

        move    #-1,m0                      ;reset to a linear buffer
        move    m0,y:<linear

;init the auto select test table of frame lengths, sample rate and bit rate
;this table as each entry with 2 words: length, sample/bit flags
```

```
; bit 0 of flag word indicates sample rate: 0 = low, 1 = high
; bit 1 of flag word indicates framing bit rate: 0 = low, 1 = high

        move    #autotbl,r0             ;table of selectable frame lengths
        move    #testtbl,r1             ;table to test from
        move    x:(r0)+,x0              ;get 1st entry frame length
        move    x0,x:(r1)+              ;store smallest frame
        move    #>1,x0                  ;indicate high sample/low bit rates
        move    x0,x:(r1)+
        move    x:(r0)+,x0
        move    x0,x:(r1)+              ;2nd smallest frame
        move    #>3,x0                  ;indicate high sample/high bit rates
        move    x0,x:(r1)+
        move    x:(r0)+,x0
        move    x0,x:(r1)+              ;2nd largest frame
        move    #0,x0                   ;indicate low sample/low bit rates
        move    x0,x:(r1)+
        move    x:(r0)+,x0
        move    x0,x:(r1)+              ;largest frame
        move    #>2,x0                  ;indicate low sample/high bit rates
        move    x0,x:(r1)

;set start-up auto selects

        bset    #0,x:autorate           ;with lower bit rate
        bset    #0,x:autocode           ;as MUSICAM
        bset    #0,x:autosmpl           ;at low sample rate 24,000

restart

        CLR_DAC_RESET                   ;clear the DAC reset line to mute output
        INTERRUPT_HOST_DCD

;turn off the interrupt system
; set the interrupt for host interrupts
; HOST set to IPL 2

        movep   #>$0800,x:<<M_IPR       ;set int priorities and edges
        andi    #$fc,mr                 ;turn on the interrupt system

;       ori     #$03,mr

;disable the ancillary data transmit interrupt

        bclr    #M_TIE,x:<<M_SCR

; bit 0
; The input state word, y:inpstat, controls data collection from the outside
; into the decoder.  If bit 0 is 0, then everytime an input occurs, event is
; counted by incrementing the input write pointer (y:inpwptr) and no data is
; stored. If bit 0 is a 1, then data is stored and the input write pointer
; is incremented.

        clr     a       #>OFF_LEDS_DCD,b        ;initialize leds as off
        move    a,y:<inpstat            ;state of the input buffer
        move    a,y:<ctlflgs            ;decoding control flags
        move    a,y:<not_appl           ;clear any stubbed flags

;initialize the led output word and light initial leds
```


BAD ORIGINAL

```
        move     b,y:<word_out
        ON_ALARM_LED_DCD                      ;light alarm led indicator
        TST_SET_ALARM_RELAY_DCD,_set_led_0 ;unless already set.
        SET_ALARM_RELAY_DCD                   ;set the alarm relay line on

_set_led_0
        OFF_LO_SAMPLE_RATE_LED_DCD
        OFF_HI_SAMPLE_RATE_LED_DCD

;*******************************************************************************
;*******************************************************************************
; TEST NOTICE THAT THE FOLLOWING DATA IS DECODED AND PUT INTO A HIGH MEMORY
; AND WILL BE CHCKED WOTH THE CODED DATA ALL THE TIME WHILE THE PROGRAM
; RUNS TO MAKE SURE THAT NONE OF A WORD IS IN ERROR
;TEST DATA

;initialize the buffer to be decoded for testing

        OFF_REED_SOL_LED_DCD                  ;indicate no problem with Reed Solomon

        move     y:<linear,m1                 ;make sure it's linear buffer
        move     y:<linear,m3                 ;make sure it's linear buffer
        move     y:<linear,m6                 ;make sure it's linear buffer

        move     #framebuf,r1                 ;code the 1st of the encoded frames
        clr      a          #>1,x0            ;zero the test value accumulator
                                              ; & to increment in the test buffer

;set the frame buffer to sequentially incremented values

        do       #96,_init1
        add      x0,a
        move     a1,x:(r1)+

_init1

;do the reed solomon encoding on the test frame buffer

        move     #syncbuf,r1                  ;o/p pointer of buffer to be RS-DECODED
        move     #RStest,r6                   ;i/p pointer for CODED data to decode
        move     #PROF1,r3                    ;Reed Solomon profile: control decode
        jsr      <rsdec16                     ;encode via reed solomon

;test if the reed solomon codec worked or NOT

        move     #syncbuf,r6                  ;pointer for DECODED data to be stored
        move     #framebuf,r1                 ;pointer for the verification table

;verify that the reed solomon coded values are correct

        do       #86,_RS_Chk                  ;Get current coded data output
        move     x:(r6)+,x0                   ;Get precoded  look up table value
        move     x:(r1)+,a                    ;compare 2 values
        cmp                 x0,a              ;If SAME No problem
        jeq                 <_Same            ;indicate no problem with Reed Solomon
        ON_REED_SOL_LED_DCD
        enddo
        nop
_Same
        nop
```

```
_RS_Chk

        SET_LEDS_DCD
        INTERRUPT_HOST_DCD

;mute current output buffer

        move    #outbuf,r7              ;setup synth variables
        jsr     <muteout                ;mute the dac output buffer

;get the external switches to determine frame bit rate
;  and ancillary data baud rate

        GET_SWITCHES_DCD gsws_00
        jsr     <getsws

;MUSICAM selections by switches set up prior to possible auto select

        move    x:tstsmpl,y1
        move    y1,y:smplrte            ;set the i/p PCM sampling rate code
        move    x:tstcode,y1
        move    y1,y:iputcde            ;set type of i/p data MUSICAM vs G722
        move    x:tstrate,y1
        move    y1,y:frmrate            ;set the frame rate i/p code

;!!!dsb 11/22/94
;;;if no auto selection required, go with the settings from the input switches
;;
;;      move    #autosel,r0
;;      nop
;;      jclr    #0,x:(r0),_onward_      ;NO auto selection required
;;
;!!!dsb 11/22/94

;if the selection of MUSICAM vs G722 is not auto selected,
;  test for MUSICAM input data stream selected versus G722 data input stream
;  and if G722 selected manually, boot rom file from lower half of the chip

        jset    #AUTO_SELECT_DATA_TYPE,y:<ctlflgs,_auto_type
        move    y:iputcde,b
        tst     b                       ;0 = MUSICAM, else G722
        jne     <g722_boot              ;if 1, it's G722, boot lower half

_auto_type

;initialize the auto select MUSICAM max tries

        move    #>MAX_BOOT_TRIES,x0
        move    x0,x:maxtries
        jsr     <autoselect             ;try for MUSICAM input data

;if autoselect successful, use the selected info

        move    #autosel,r0
        nop
        nop
        nop
        jclr    #0,x:(r0),_onward_      ;NO auto selection required

;if auto select for MUSICAM_vs_G722, it must be G722
```

```
        nop
        nop
        nop
        nop
        nop
        jset    #AUTO_SELECT_DATA_TYPE,y:<ctlflgs,g722_boot

;indicate not MUSICAM framed

        ON_FRAME_LED_DCD                ;set the framing led alarm
        SET_LEDS_DCD
        INTERRUPT_HOST_DCD
        jmp     <restart                ;try for new switch settings

_onward_

;everything for MUSICAM selected by switches or auto selection

        move    x:tstsmpl,y1
        move    y1,y:smplrte            ;set the i/p PCM sampling rate code
        move    x:tstcode,y1
        move    y1,y:iputcde            ;set type of i/p data MUSICAM vs G722
        move    x:tstrate,y1
        move    y1,y:frmrate            ;set the frame rate i/p code
        move    x:tstbaud,y1
        move    y1,y:baudrte            ;set ancillary data baud rate code

;;test for the diagnostic method of operation
;
;       TST_CLR_DIAGNOSTICS_DCD,_go_fwd ;if normal operation, continue
;
;;diagnostic method of operation selected, reboot from the low portion of chip
;
;       bclr    #11,x:<<M_PBD           ;clr boot c000 for rdcddiag boot 10000
;
;       jmp     <bootup
;
;_go_fwd

; set the values for the data collection routine.
; This is used for setting the value for the mod buffer ctls
;       y:framesz       input for purposes of framing
;       y:frmemod       normal framed input (double buffered-2 frames)
; but setting the address of a buffer (y:inpwptr) can't hurt either.

        move    #syncbuf,a0             ;set input word pointer
        move    a0,y:<inpwptr
        move    #framebuf,a0            ;buffer addr of MUSICAM decode buffer
        move    a0,y:inpaddr            ;store input buf addr for saving frame

;set access to the flags resulting from autosel framing pattern match:
;       bit 0 - sampling rate:      0 = low, 1 = high
;       bit 1 - framing bit rate:   0 = low, 1 = high
;       bit 2 - ISO vs old CCS:     0 = ISO, 1 = old ccs CDQ1000
;       bit 3 - CRC-16 protection:  0 = yes, 1 = unprotected

        move    #chkflags,r1            ;to test results of autosel match

;based on the sampling rate and framing bit rate selected:
```

```
;       set the sampling rate code for the ISO frame header
;       set the framing bit rate code for the ISO frame header
;       set the frame  size in words and bits

        move    #samplng,r0             ;addr of sampling rate codes
        move    y:smplrte,b             ;offset to sampling code table
        tst     b       #10,n0          ;test for sampling rate of zero
                                        ; & set register to advance thru table
        jeq     <_smplcds_              ;if code is zero, we're there

        rep     b
        move    (r0)+n0                 ;position to selected sampling rate code

_smplcds_
        move    #4,n0                   ;offset MPEG-ISO vs old CCS values
        jclr    #2,x:(r1),_smpl_cds_    ;if ISO, r0 is all set for ISO values
        move    (r0)+n0                 ;offset to old CCS CDQ1000 values

_smpl_cds_
        move    y:(r0)+,x0              ;get frame header sampling code
        move    x0,y:smplcde            ;save code to match in the frame header
        move    y:(r0)+,x0              ;get frame header sampling id bit
        move    x0,y:smplidbit          ;save code to match in the frame header
        move    y:(r0)+,x0              ;get 1 channel frame maximum sub-bands
        move    x0,y:maxsubs_1          ;save max sub-bands for decoding mono
        move    y:(r0)+,x0              ;get 2 channel frame maximum sub-bands
        move    x0,y:maxsubs_2          ;save max sub-bands for decoding dual
        move    y:frmrate,b             ;test bit rate to set audio data size
        move    #bitrates,r0            ;addr of framing bit rate info
        tst     b       #8,n0           ;test for rate of zero
                                        ; & set register to advance thru table
        jeq     <_bit_offs_             ;if code is zero, we're there

        rep     b
        move    (r0)+n0                 ;position to selected bit rate code

_bit_offs_

;set the table offset based on sampling rate

        move    y:smplrte,b             ;get the sample rate code
        tst     b       #4,n0           ;test if low sampling rate
                                        ; & set offset to proper sampling rate
        jeq     _bit_smpl_              ;if low rate, addr is set

        rep     b
        move    (r0)+n0                 ;position to selected sample rate

_bit_smpl_
        move    y:(r0)+,x0              ;get ISO bit rate code in frame header
        jclr    #2,x:(r1),_bit_rate_    ;if ISO, x0 is all set with ISO code
        move    y:(r0),x0               ;get old CCS bit rate code in frame hdr

_bit_rate_
        move    x0,y:bitrate            ;save frame header bit rate code
        move    #>1,x0                  ;to subtract 1 for mod buffer ctl below
        move    (r0)+                   ;advance to sampling rate lengths
        move    y:(r0),b                ;kbit/sec rate frame size in words
        move    b,y:frmsize             ;set # of words in a frame
        sub     x0,b                    ;to set decode framebuf mod ctl
```


BAD ORIGINAL

```
        move    b1,y:dcdfrmod           ;set MUSICAM decode framebuf mod ctl
        move    y:frmsize,b             ;get # of words in a frame
        lsl     b                       ;double buffer framed i/p buffer
        sub     x0,b    #>NSBUFS,x1     ;subtract 1 for mod buffer control
                                        ;& set number of frames to check
        move    b1,y:frmemod            ;save mod buffer control - 2 frames
        add     x0,b    y:frmsize,y1    ;re-add 1 to calculate 1/2 frame size
                                        ; and get full frame for below
        lsr     b                       ;frame size divided by 2
        move    b1,y:frmhalf            ;save 1/2 frame size (1 full frame

;now calculate the framing buffer circular mod control size

        mpy     x1,y1,a #>1,y0          ;times frame size
                                        ; and set up 1 to decrement
        asr     a                       ;align integer result
        move    a0,a                    ;shift integer result
        sub     y0,a                    ;minus 1 for mod buffer control
        move    a1,y:framesz            ;save framing mod buffer control

;set up for ancillary data to be decoded from a framed and transmit via rs232
;       a. set address of clock table, baudclk, based on baud rate (0 thru 7
;       b. set table offset by baud rate;
;          (these are standard CDQ2000 set by macro, BAUDCLK, in box_ctl.asm):
;               0 = 300 baud
;               1 = 1200 baud
;               2 = 2400 baud
;               3 = 3200 baud
;               4 = 4800 baud
;               5 = 38400 baud
;               6 = 9600 baud
;               7 = 19200 baud
;       c. set transmit enable
;       d. get and set the clock for baud rate from the table
;       e. adjust to the sampling rate info
;       f. get and set the max bytes for baud rate from the table

        move    #baudclk,r0             ;get data baud rate table address
        move    y:baudrte,b             ;set to access clock at baud rate
        bset    #M_TE,x:<<M_SCR         ;set transmit enable
        tst     b       #3,n0           ;test for rate of zero
                                        ; & set register to advance thru table
        jeq     <_baud_cds_             ;if code is zero, we're there

        rep     b
        move    (r0)+n0                 ;position to selected baud rate code

_baud_cds_

        move    y:(r0)+,r2              ;get clock value at baud rate
        move    y:smplrte,n0            ;now get sampling rate offset
        movep   r2,x:<<M_SCCR           ;set the clock for selected baud rate
        move    y:(r0+n0),n1            ;get max byte count at sampling rate
        move    n1,y:maxbytes           ;store maxbytes for scixmt to check

;set flags for sampling rate and type of data received

;!!!dbg
;       move    y:frmrate,b
;       tst     b
```

```
;       jeq     <_bit_lo_                   ;!!!dbg
;
;       SET_HI_BIT_RATE_DCD
;       jmp     <_smpl_
;
;_bit_lo_
;       SET_LO_BIT_RATE_DCD
;
;
;_smpl_
;!!!dbg
        move    y:smplrte,b
        tst     b       y:iputcde,b
;!!!dbg
        jeq     <_type_
;       jeq     <_smpl_lo_                  ;!!!dbg

        bset    #SAMPLE_RATE_LOW_vs_HIGH,y:<ctlflgs
;       SET_HI_SAMPLE_RATE_DCD
;       jmp     <_type_
;
;;!!!dbg
;_smpl_lo_
;       SET_LO_SAMPLE_RATE_DCD
;
_type_

;test for MUSICAM input data stream selected versus G722 data input stream

        tst     b                           ;0 = MUSICAM, else G722
        jeq     <rate_                      ;if 0, it's MUSICAM, test bit rate

g722_boot

;G722 input selected, signal the encoder XMICRMUS and
;       boot up RMCRG722 from the low portion of chip

;!!!2/7/1994    SET_G722_DATA_DCD
        bset    #MUSICAM_vs_G722,y:<ctlflgs
        OFF_FRAME_LED_DCD                   ;douse the framing led alarm
        OFF_CRC_ERROR_LED_DCD               ;douse the crc error led alarm
        OFF_MONO_LED_DCD                    ;douse the mono led indicator
        OFF_JOINT_LED_DCD                   ;douse the joint stereo led indicator
        OFF_STEREO_LED_DCD                  ;douse the stereo led indicator
        OFF_LO_BIT_RATE_LED_DCD
        OFF_HI_BIT_RATE_LED_DCD
;       ON_G722_LED_DCD                     ;light the G722 front panel led
        OFF_MUSICAM_LED_DCD
        OFF_LO_SAMPLE_RATE_LED_DCD
        OFF_HI_SAMPLE_RATE_LED_DCD
        SET_LEDS_DCD                        ;set the leds as needed
        INTERRUPT_HOST_DCD
        bclr    #11,x:<<M_PBD               ;clr boot c000 for RMCRG722 boot :0000
        jmp     <bootup                     ;boot in RMCRG722

rate_
;!!!dbg
;       SET_MUSICAM_DATA_DCD    ;!!!dbg

; setup synth variables
```

```
        move    #outbuf,r7              ;setup synth variables
        move    #2,n7                   ;set to skip left and right
        move    #OUTBUF-1,m7            ;set circular outbuf ctl
        move    r7,r0                   ;set up to set read and write ptrs
        jsr     <alignptr               ;set ptrs

; Now set priorites of the IRQA and SSI peripherals
; IRQA priority = 0 turned off
; HOST set to IPL 2
; SSI  priority = 2
; SCI  priority = 2

;       movep   #>$a000,x:<<M_IPR       ;set int priorities and edges
        movep   #>$a800,x:<<M_IPR       ;set int priorities and edges

;!!!debug  tickle to see it chip booted
;
;_loop
;       bset    WATCH_DOG
;       bclr    WATCH_DOG
;       jmp     <_loop

;wait for the dust to settle before pushing onward

;KM     move    #>RDCDSYNT_STARTUP,a
;KM     jsr     <wait

        andi    #$fc,mr                 ;turn on the interrupt system

; NOW we are alive with interrupts on!

; Set the addresses of inbuf and nxtbuf to receive the input data.

reframe

        bclr    #M_TIE,x:<<M_SCR        ;disable anc data transmit interrupt

        CLR_DAC_RESET                   ;clear the DAC reset line to mute output

;if G722 data input, go to the RMCRG722 boot-up routine

        jset    #MUSICAM_vs_G722,y:<ctlflgs,g722_boot

;since it's musicam, keep in this routine and set indicators

        SET_MUSICAM_DATA_DCD
        ON_MUSICAM_LED_DCD
        OFF_G722_LED_DCD
        ON_FRAME_LED_DCD                ;set the framing led alarm
        ON_CRC_ERROR_LED_DCD            ;set the crc error led alarm
        OFF_MONO_LED_DCD                ;set the mono led indicator
        OFF_JOINT_LED_DCD               ;set the joint stereo led indicator
        OFF_STEREO_LED_DCD              ;set the stereo led indicator

; set micro leds and indicators

        move    #frmrate,r0
        nop                             ;test for frame higher Kbit rate
        jset    #0,y:(r0),_do_hi_
        SET_LO_BIT_RATE_DCD
```

```
        ON_LO_BIT_RATE_LED_DCD
        OFF_HI_BIT_RATE_LED_DCD
        jmp     <_do_coding_

_do_hi_
        SET_HI_BIT_RATE_DCD
        ON_HI_BIT_RATE_LED_DCD
        OFF_LO_BIT_RATE_LED_DCD

_do_coding_
        jset    #SAMPLE_RATE_LOW_vs_HIGH,y:<ctlflgs,_hi_rte_ ;test hi sample
        SET_LO_SAMPLE_RATE_DCD
        ON_LO_SAMPLE_RATE_LED_DCD
        OFF_HI_SAMPLE_RATE_LED_DCD
        jmp     <_do_plld_

_hi_rte_
        SET_HI_SAMPLE_RATE_DCD
        ON_HI_SAMPLE_RATE_LED_DCD
        OFF_LO_SAMPLE_RATE_LED_DCD

_do_plld_

;check the phase lock loop signal:

        TST_SET_PHASE_LOCK_DCD,_set_PLL
        OFF_PHASE_LOCK_LED_DCD              ;turn off phase lock led indicator
        jmp     <_set_alm

_set_PLL
        ON_PHASE_LOCK_LED_DCD               ;turn on phase lock led indicator

_set_alm
        ON_ALARM_LED_DCD                    ;set alarm led indicator

        TST_SET_ALARM_RELAY_DCD,_set_led_A ;unless already set,
        SET_ALARM_RELAY_DCD                 ;set the alarm relay line on

_set_led_A
        SET_LEDS_DCD                        ;set the leds as needed
        INTERRUPT_HOST_DCD

;mute the audio output until we are framed

        jsr     <muteout                    ;mute the dac output buffer

;controls to force a reboot if an inordinate number of framing errors

        move    y:frtries,a                 ;get frame tries
;       move    #>MAX_TRIES,x0              ;get number of tries tolerance
        move    #>3,x0                      ;get number of tries tolerance
        cmp     x0,a    #>1,y0              ;make test & set up to incr count
;       jge     *                           ;kill watch dog, if reached tolerance
        jlt     <_dsb_dbg_

;if manual auto selection, do not force a reboot

        move    #autosel,r0
        nop
        jclr    #0,x:(r0),_manual_restart         ;manual select, do not reboot
```

```
        nop
        nop
        nop
        nop
        nop
        jmp     *                               ;kill watch dog
;       jmp     <restart                        ;kill watch dog

_manual_restart

;if in manual mode, zero the failure counter

        clr     a
        move    a,y:frtries
        nop
        nop
        nop
        nop
        nop
        jmp     <restart                        ;in manual mode start over

_dsb_dbg_
        add     y0,a    #syncbuf,r0             ;increment count of frames
                                                ; & get address of sync buffer
        move    a,y:frtries                     ;update count of framing tries
        jsr     <framit                         ;and frame the data

;test for successful framing, if not, restart

        tst     a       r3,y:IPbitoff           ;test if framed (a = 0 if framed)
                                                ; & save the bit offset
        jeq     <_ok_
;       jne     <restart                        ;NO, we must restart
        nop
        nop
        nop
        nop
        jmp     <restart
_ok_

;since we have MUSICAM frames, set the flag for auto select switches

        bset    #MUSICAM_INPUT_SET,y:<ctlflgs

;indicate to encoder that the decoder is framed and to use pins for:
;       MUSICAM  vs G722
;       LOW vs HIGH sampling rate
;(otherwise, if auto selected and pin 14 is still low, encoder operates
;       at MUSICAM at the LOW sampling rate)

        SET_DECODER_FRAMED_DCD

;initialize the polysynthesis arrays for the 1st frame

        jsr     <polysini

; the a reg is returned as 0 to go on
;clear the successive CRC-16 bit error sensed counter
; if exceeded according to the chkcrc routine, automatically reframe
```

```
        move    a,y:biterrs              ;zero the bit error counter
        move    a,y:oof                  ;zero out-of-frame faults counter
        move    a,y:voof                 ;zero sample rate code faults counter
        move    a,y:pocf                 ;zero CRC protection code faults counter
        move    a,y:doof                 ;0 ancil data errors/old CCS CRC-16 cntr
        move    r5,y:IPwrdoff            ;save i/p buufer word offset
        bclr    #FIRST_TIME,y:<ctlflgs   ;clear the indicator
        bclr    #FRAME_SAVED,y:<ctlflgs  ;clear the indicator
        bclr    #USE_SAVED,y:<ctlflgs    ;clear the indicator
        bclr    #SAVE_FRAME,y:<ctlflgs   ;clear the indicator
        bclr    #USING_SAVED,y:<ctlflgs  ;clear the indicator
        bclr    #REFRAME,y:<ctlflgs      ;clear the indicator

        OFF_FRAME_LED_DCD                ;douse decoder framed alarm led
        SET_LEDS_DCD                     ;set the leds as needed
        INTERRUPT_HOST_DCD

;for ancillary data decoding purposes, determine the end of the coded frame

        jsr     <framend

;initialize the ancillary data controls for decoding and transmission

        clr     a       #databytes,r0    ;zero the decoded byte counter
                                         ; & get addr of the data byte buffer
        move    a,y:bytecnt              ;bytes decoded counter set to zero
        move    r0,y:dataiptr            ;address for next byte decoded
        move    r0,y:dataoptr            ;addr for next byte to out RS232
        do      #DATABUFLEN,_clr_data
        move    a,y:(r0)+                ;zero the ancillary data buffer

_clr_data
        bset    #M_TIE,x:<<M_SCR         ;set the data transmit interrupt

; Let the show begin.

top

;get the external switches to determine if any changes that signal a restart

        GET_SWITCHES_DCD gsws_20
        jsr     <getsws
;       jset    #4,y:<not_appl,restart
        jclr    #4,y:<not_appl,_ok_2_
        nop
        nop
        nop
        nop
        jmp     <restart
_ok_2_

;check the phase lock loop signal:

        TST_SET_PHASE_LOCK_DCD,_set_ph

; if not set, clear the phase lock loop led and light the alarm led

        CLR_DAC_RESET                    ;clear the DAC reset line to mute output
```

```
        OFF_PHASE_LOCK_LED_DCD          ;turn off phase lock led indicator
        ON_ALARM_LED_DCD                ;light alarm condition led indicator
        TST_SET_ALARM_RELAY_DCD,_set_led_B
        SET_ALARM_RELAY_DCD
        jmp     <_set_led_B

_set_ph

;  else, light the phase lock loop led
;       and if there is no CRC bit error, clear the alarm led

        ON_PHASE_LOCK_LED_DCD           ;light phase lock loop led indicator
;       TST_SET_CRC_ERROR_DCD,_set_alm_A ;if crc error set, turn alarm led on
        OFF_ALARM_LED_DCD               ;turn off alarm led indicator

        TST_CLR_ALARM_RELAY_DCD,_set_led_B
        CLR_ALARM_RELAY_DCD
        jmp     <_set_led_B

_set_alm_A
        ON_ALARM_LED_DCD                ;light alarm condition led indicator

        TST_SET_ALARM_RELAY_DCD,_set_led_B
        SET_ALARM_RELAY_DCD

_set_led_B
        OFF_OVERLOAD_LED_DCD            ;clear decoder overload alarm led
        SET_LEDS_DCD                    ;set the leds as needed
        INTERRUPT_HOST_DCD

;       bset    WATCH_DOG               ;tickle the dog
;       bclr    WATCH_DOG

; Now wait until we have 1 word in the input buffer
; The varible waitform contains the address of one word after the sync word.
; This is the word to wait for in the interrupt routine to signal the
; start of a new frame.

        move    y:frmemod,m0            ;set up m0 as a mod buffer of one frame
        move    y:frmsize,n0            ;get buffer length
        move    y:IPwrdoff,r0           ;word offset for frame start
        move    y:frmsize,a             ;get 1/2 buffer length: frame length
        lsl     a                       ;times 2
        move    a1,y0                   ;set framing buf length for addr compare
        move    (r0)+n0                 ;increment to next input frame
        move    r0,y:IPwrdoff           ;save new offset word to start of frame
        move    (r0)+                   ;increment 1 word
        move    r0,x0                   ;set as address to wait for
        move    y:<linear,m0            ;restore r0 to linear addressing
        move    y:frmsize,x1            ;get half the framing buffer size

; Here we check if we have received enough data to proceed
; This is done by checking by subtracting the

_rdec_15

;       bset    WATCH_DOG               ;tickle the dog
;       bclr    WATCH_DOG

        move    y:<inpwptr,a            ;get curr read frames i/p ptr
```

```
        sub     x0,a                            ;sub addr to wait for
        jge     <_rdec_20                       ;check for zero addr wrap around
        add     y0,a                            ;bump result by framing buffer length

_rdec_20
        cmp     x1,a                            ;see if past a half a buffer
        jlt     <_rdec_15                       ;if not yet at the half-way, loop

;!!!DGCST
;;;if required for even frame sizes when auto select sampling rate,
;;; make sure no rate switch fooled the decoder
;;
;;      VERIFY_AUTO_SAMPLE                      ;as needed by box_ctl.asm
;;
;!!!DGCST

;take the next frame to decode and word align it for reed solomon decoding

        move    y:IPwrdoff,r0     ;get the word offset for the next fame to decode
        move    #syncbuf,n0       ;base address of the i/p frame buffer
        move    y:frmemod,m0      ;doubled buffer i/p
        move    #reedsolbuf,r1    ;addr for Reed Solomon i/p buffer
        move    #framebuf,r2      ;addr for MUSICAM decode frame i/p buffer
        move    (r0)+n0           ;get to start addr of current i/p frame
        move    y:frmsize,n0      ;number of words in a frame
        move    y:IPbitoff,b      ;bit offset to sync pattern in 1st word

;for the length of a full frame,
;       get the words in pairs and shift to word boundary

        do      n0,_reed_shift
        move    x:(r0)+,a1        ;1st word of the curr pair to shift

;if words already are aligned, simply copy the word to the Reed Solomon buffer

        tst     b       x:(r0),a0       ;see if a shift is needed,
                                        ; & get 2nd word of curr pair to shift
        jeq     <_no_shift        ;if no offset, no shift needed

;for the number of offset bits, shift the pair of words to abut properly aligned

        rep     b
        asl     a

_no_shift

;copy aligned word in Reed Solomon buffer for decoding

;!!!dbg
        move    a1,x:(r1)+
        move    a1,x:(r2)+                      ;also copy to MUSICAM frame buffer

_reed_shift

;decode the Reed Solomon frame back to a MUSICAM frame

        move    y:<linear,m0                    ;restore r0 to linear addressing
        move    #reedsolbuf,r6                  ;Reed Solomon frame buffer: i/p
        move    #framebuf,r1                    ;frame buffer decoded: o/p
        move    #PRCF1,r3                       ;Reed Solomon profile: control decode
```

```
        jsr     <rsdec16                   ;do Reed Solomon decode

; Now setup the buffer reading routines

        move    y:dcdfrmod,m6              ;decoded Reed Sol frame bufmod ctl
        move    #framebuf,n6               ;decoded Reed Solomon frame buffer addr
        move    y:wrdoff,r6                ;bit offset from msb
        move    y:bitoff,a                 ;bit offset from msb

        bclr    #USE_SAVED,y:<ctlflgs      ;clear used saved frame flag
        bclr    #USING_SAVED,y:<ctlflgs    ;clear using saved frame flag

;       OFF_CRC_ERROR_LED_DCD              ;turn off the crc error led indicator
        TST_SET_PHASE_LOCK_DCD,_clr_alm_A  ;if not phase loop locked, then

        CLR_DAC_RESET                      ;clear the DAC reset line to mute output

        ON_ALARM_LED_DCD                   ;light alarm led indictor
        TST_SET_ALARM_RELAY_DCD,_set_led_C
        SET_ALARM_RELAY_DCD                ;turn the alarm relay on
        jmp     <_set_led_C

_clr_alm_A

;release the digital to analog converter for output

        SET_DAC_RESET                      ;set the DAC reset line high now

        OFF_ALARM_LED_DCD                  ;turn off alarm led indicator
        TST_CLR_ALARM_RELAY_DCD,_set_led_C
        CLR_ALARM_RELAY_DCD                ;turn the alarm relay off

_set_led_C
        SET_LEDS_DCD                       ;set the leds as needed
        INTERRUPT_HOST_DCD

        bclr    #SAVE_FRAME,y:<ctlflgs     ;clr ind for getvalue to save frame wds

;Now we are ready to decode the current frame using:
;  n6 = buffer address
;  r6 = word offset into the buffer for start of the frame
;  a  = bit offset into the word offset into the buffer for start of the frame
;  m6 = mod buffer control through the buffer this will be either
;       normal input for 3 * frame size -1 (leaves space for saved buffer)
;       single frame size -1 for using the saved frame if a checksum error)

_rdec_30

;!!!dgsct        bset    WATCH_DOG               ;tickle the dog
;!!!dgsct        bclr    WATCH_DOG               ;tickle the dog

        TOGGLE_WATCH_DOG_DCD

        jsr     <bitsallo

;prepare to suppress ancillary data if any out of frame condition

        bclr    #NO_SYNC,y:<ctlflgs        ;clear the indicator

; Now get the sync pattern.  If the pattern matches a good sync, then
```

```
; the oof counter is decremented. If it doesn't match, the oof pattern
; is incremented.  If it is incremented past an upper limit, an out of
; frame condition is declared and the system goes into framing.
; On the other hand, the oof counter is never allowed to go negative.

        jsr     <getsync                        ;get the sync bits

        move    a1,y0                           ;move right justified value
        move    y:oof,b                         ;get current # of oof's

;if using the saved frame, do not recount sync problems

        jset    #USE_SAVED,y:<ctlflgs,_rdec_50
        move    #>SYNC,a                        ;get sync pattern for test
        cmp     y0,a    #>GOOD_DECREMENT,x1     ;do we have a valid sync
                                                ; & set good sync decrement value
        jeq     <_rdec_40

; We are here because the sync did not match.
; Increment the number of bad syncs found.

        bset    #NO_SYNC,y:<ctlflgs             ;set indicator to skip ancillary data

        move    #>BAD_INCREMENT,x1              ;set the bad match increment value
        add     x1,b    #>BAD_LIMIT,x0          ;increment the number of oof's
                                                ; & set limit value to restart
        cmp     x0,b                            ;see if at the limit
        jlt     <_rdec_50                       ;we are not, so keep going

        nop
        nop
        nop
        nop
        nop

;we've sensed too many sync pattern failures in succession

        TOO_MANY_SYNC_ERRORS_DCD

;!!!rmicrmus    jmp     <restart                ;at error limit so reframe

; We are here because a valid sync was found.
; Decrement the number of bad syncs found.

_rdec_40
        sub     x1,b                            ;decrement the number of oof's
        tst     b       #0,x1                   ;see if at the limit
        tlt     x1,b

_rdec_50
        move    b,y:oof                         ;save the current oof counter

;get the sytem header info

        jsr     <getsyst                        ;get system header info

;see if the frame header sample rate code matches determined sampling rate
; If the sample rate codes match a good sync, then the voof counter is
; decremented.
; If the codes don't match, the voof counter is incremented.
```

```
; If the voof counter is incremented past an upper limit, we have to
; do the auto selection again since perhaps the sampling rate has changed.

        move    y:svesmpl,a                 ;get code from frame header
        move    y:smplcde,x0                ;get code determined by framing
        move    y:voof,b                    ;get current # of voof's
        cmp     x0,a    #>GOOD_DECREMENT,x1     ;is a valid sample rate code
                                            ; & set good code decrement value
        jne     <_ck_smpl_05                ;if we don't that's bad

;now check the frame header ID that matches the sample rate

        move    y:sveidbit,a                ;get ID from frame header
        move    y:smplidbit,x0              ;get ID determiend by framing
        cmp     x0,a                        ;see if a match
        jeq     <_ck_smpl_10                ;if we do that's good

_ck_smpl_05

; We are here because there was no match of the sample rate codes.
; Increment the number of unmatches found.

        move    #>BAD_INCREMENT,x1          ;set the bad match increment value
        add     x1,b    #>BAD_LIMIT,x0      ;increment the number of voof's
                                            ; & set limit value to restart
        cmp     x0,b                        ;see if at the limit
        jlt     <_ck_smpl_20                ;we are not, so keep going
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        jmp     <restart                    ;at error limit so restart

; We are here because a valid sample rate was found in the frame header.
; Decrement the number of unmatched sample rate codes.

_ck_smpl_10
        sub     x1,b                        ;decrement the number of voof's
        tst     b       #0,x1               ;see if at the limit
        tlt     x1,b                        ;if less than zero, set to zero

_ck_smpl_20
        move    b,y:voof                    ;save the current voof counter

;see if the frame header CRC protection code matches determined protection code
; If the codes match, then the poof counter is decremented.
; If the codes don't match, the poof counter is incremented.
; If the poof counter is incremented past an upper limit, we have to
; do the auto selection again since perhaps the CRC protection has changed.

        move    y:poof,b                    ;get current # of poof's
        move    #>GOOD_DECREMENT,x1         ;set good match decrement value

; verify the CRC PROTECT setting versus auto sampling:
;       if the frame header shows CRC protection,
;               verify auto sample also indicates protection
```

```
        jset    #PROTECT,y:<ctlflgs,_ck_prot_00 ;if protect, check auto

;frame shows no protection,
;  if auto sampling also found no protection,
;       go to decrement the poof counter
;  otherwise, force protection and assume a bit error
;               and increment the poof counter

        jset    #0,y:<protect,_ck_prot_10       ;if match, decrement poof
        bset    #PROTECT,y:<ctlflgs     ;set the CRC applies bit
        jmp     <_ck_prot_05            ;go to increment poof for the bad match

_ck_prot_00

;frame shows protection,
;  if auto sampling also found protection, continue
;  otherwise, force no protection and assume a bit error
;               and increment the poof counter

        jclr    #0,y:<protect,_ck_prot_10       ;if match, decrement poof
        bclr    #PROTECT,y:<ctlflgs     ;clear the CRC applies bit

_ck_prot_05

; We are here because there was no match of the CRC protection codes.
; Increment the number of unmatches found.

        move    #>BAD_INCREMENT,x1      ;set the bad match increment value
        add     x1,b    #>BAD_LIMIT,x0  ;increment the number of poof's
                                        ; & set limit value to restart
        cmp     x0,b                    ;see if at the limit
        jlt     <_ck_prot_20            ;we are not, so keep going
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        jmp     <restart                ;at error limit so restart

; We are here because a valid CRC protection code was found in the frame header.
; Decrement the number of unmatched CRC protection codes.

_ck_prot_10
        sub     x1,b                    ;decrement the number of poof's
        tst     b       #0,x1           ;see if at the limit
        tlt     x1,b                    ;if less than zero, set to zero

_ck_prot_20
        move    b,y:poof                ;save the current poof counter

;if there is CRC-16 protection on the frame:
; set the CRC-16 checksum bit count for the old ISO method:
;  a. header bits covered by any type of frame
;       plus bits for the left channel also apply to any type of frame
;  b. set bits for possible right channel based on frame type
;  c. if not MONO, add bits for right channel
;  d. save old ISO bit count for this frame
```

```
        jclr    #PROTECT,y:<ctlflgs,_rdec_60    ;if no checksum, get allocations

        move    #>CRC_BITS_A+CRC_BITS_B,a
        move    #>CRC_BITS_B,x0         ;bit count for right channels
        jset    #STEREO_vs_MONO,y:<ctlflgs,_rdec_52
        add     x0,a                    ;since its stereo, add for right channel
_rdec_52
        move    a,x:crcold              ;set the old ISO CRC-16 bit count

;       bset    WATCH_DOG               ;tickle the dog
;       bclr    WATCH_DOG               ;tickle the dog

        jsr     <getcrc                 ;get checksum from frame

_rdec_60
        move    #SBIndx,r0              ;address of sub-band indicies
        jsr     <getbal                 ;get bit allocations

        move    #SBits,r0               ;address of SB bits array
        move    #SBIndx,r1              ;address of sub-band indicies
        jsr     <getsbits               ;get the sb bits

        move    #SBndSKF,r0             ;address of the SB scale factors
        move    #SBits,r1               ;address of SB bits array
        move    #SBIndx,r2              ;address of sub-band indicies
        jsr     <getskf                 ;get scale factors

        jclr    #PROTECT,y:<ctlflgs,_rdec_70    ;if no checksum, get data pts
;!!!dbg
;       jmp     <_rdec_70
;!!!dbg

;       bset    WATCH_DOG               ;tickle the dog

;       jset    #USE_SAVED,y:<ctlflgs,_rdec_70  ;do not recheck saved frame
        jsr     <chkcrc                 ;check the validity of frame
;       jset    #REFRAME,y:<ctlflgs,reframe     ;if too many bit errors, reframe
        jclr    #REFRAME,y:<ctlflgs,_dbg_dsb_   ;if too many bit errors, reframe
        nop
        nop
        nop
        nop
        nop
        TOO_MANY_BIT_ERRORS_DCD

_dbg_dsb_
        jclr    #USE_SAVED,y:<ctlflgs,_rdec_65  ;if valid, continue with frame
        jclr    #USING_SAVED,y:<ctlflgs,_rdec_65 ;if saved valid, continue

        ON_CRC_ERROR_LED_DCD            ;light crc error alarm led
        ON_ALARM_LED_DCD                ;light alarm led indicator
;       TST_SET_ALARM_RELAY_DCD,_set_led_D
;       SET_ALARM_RELAY_DCD             ;turn the alarm relay on

_set_led_D
        SET_LEDS_DCD                    ;set the leds as needed
        INTERRUPT_HOST_DCD

        jclr    #FRAME_SAVED,y:<ctlflgs,_rdec_80 ;else failed, if no saved frame
```

```
                                        ; output zeroes and try again
        bclr    #FRAME_SAVED,y:<ctlflgs ;clear since we used the saved frame
        move    #savebuf,n6             ;else, set up last saved frame
        move    y:wrdoff,r6             ;word offset was saved
        move    y:bitoff,a              ;bit offset was saved

        jmp     <_rdec_30               ;go back and do last frame again

_rdec_65

        OFF_CRC_ERROR_LED_DCD           ;turn off the crc error alarm led

;       bclr    WATCH_DOG               ;tickle the dog

_rdec_70

;now, light the proper led for the type of framing:
;       full stereo, joint stereo, dual channel or mono

        jset    #STEREO_vs_MONO,y:<ctlflgs,_rdec_53     ;if mono
        jset    #JOINT_FRAMING,y:<ctlflgs,_rdec_51      ;if joint stereo

        OFF_MONO_LED_DCD                ;turn off the mono led indicator
        OFF_JOINT_LED_DCD               ;turn off the joint stereo led indicator
        ON_STEREO_LED_DCD               ;light the stereo led indicator
        jmp     <_rdec_55

_rdec_51
        OFF_MONO_LED_DCD                ;turn off the mono led indicator
        OFF_STEREO_LED_DCD              ;turn off the stereo led indicator
        ON_JOINT_LED_DCD                ;light the joint stereo led indicator
        jmp     <_rdec_55

_rdec_53
        OFF_STEREO_LED_DCD              ;turn off the stereo led indicator
        OFF_JOINT_LED_DCD               ;turn off the joint stereo led indicator
        ON_MONO_LED_DCD                 ;light the mono led indicator

_rdec_55
        SET_LEDS_DCD                    ;set the leds as needed
        INTERRUPT_HOST_DCD

;test if the fade controls are applicable

        TST_CLR_FADE_OUTPUT_DCD,_fade_5 ;if fade not requested, continue
        move    y:fadecnt,b             ;get fade frame counter
        tst     b       #>1,x0          ;test if ready to fade (fadecnt=0)
                                        ; & set to decrement frame count
        jne     <_fade_3                ;not ready yet, go decrement
        move    y:fade,a                ;get current fade value
        move    #>FADE_SOFTEST,y0       ;get maximum fade down range
        TST_SET_FADE_DOWN_DCD,_fade_1   ;increment to soften output
        tst     a       #>FADE_START_UP,x1 ;test if at loudest fade up
                                        ; & get test for max start fade value
        jeq     <_fade_5                ;if at loudest, continue
        cmp     x1,a    #>FADE_INCREMENT,x0 ;test if above max start fade
                                        ; & get scale factor increment
        tgt     x1,a                    ;if needed, set start fade up
        sub     x0,a    #>FADE_FRAMES,b ;adjust louder for this frame
                                        ; & set frame count to next decrement
```

```
        jmp     <_fade_2                        ;store new fade SKF adjust value

_fade_1
        cmp     y0,a    #>FADE_INCREMENT,x0
        jeq     <_fade_5                        ;if at softest, continue
        add     x0,a    #>FADE_FRAMES,b ;adjust softer for this frame
                                        ; & set frame count to next decrement

_fade_2
        move    a,y:fade                        ;save the new fade SKF adjust value
        jmp     <_fade_4

_fade_3
        sub     x0,b                            ;decrement frame counter

_fade_4
        move    b,y:fadecnt                     ;save the new fade frame counter

_fade_5

;if 1st frame align the ptrs for the polysynthes

        jset    #FIRST_TIME,y:<ctlflgs,_rdec_57
        move    r7,r0                           ;align the read & write ptrs
        jsr     <alignptr                       ;set ptrs
        bset    #FIRST_TIME,y:<ctlflgs  ;indicate ptrs have been aligned

_rdec_57
        move    #SBIndx,r3                      ;sb indicies
        move    #SBndSKF,r2                     ;get the scale factors
        move    #ASMData,r1                     ;set A share mem of rec samples
        jsr     <getdata                        ;get the sub-band data

        jsr     <getancdata                     ;process ancillary data

;maintain the frame counter of successive frames with the old CCS CRC-16
; checksum coupled with ancillary data decoding problems.
; If the no error was detected, then the doof counter is decremented.
; If there was an error, the doof pattern is incremented.  If it is
; incremented past an upper limit, an out of frame condition is declared
; and the system may go into reframing swapping the old CCS decoding for
; MPEG-ISO decoding or vice versa.
; The doof counter is never allowed to go negative.

        move    y:doof,b                        ;get current # of doof's

; A saved frame is not included in maintaining the doof's counter.

        jset    #USE_SAVED,y:<ctlflgs,_rdec_150

;check if a problem with old CCS CRC-16 algorithm coupled with
;  a problem with ancillary data.

        move    #oldccs,r1                      ;addr to test ancillary data problem
        move    #>GOOD_DECREMENT,x1             ;to decrement error frame counter
        jclr    #2,y:(r1),_rdec_140             ;if no ancillary data error, decrement

; We are here because there was an ancillary data problem/old CCS CRC-16
; Increment the number of bad frames found.
```

```
        move    #>BAD_INCREMENT,x1          ;to increment the number of doof's
        add     x1,b    #>BAD_LIMIT,x0      ;increment the number of doof's
                                            ; & set limit value to restart
        cmp     x0,b                        ;see if at the limit
        jlt     <_rdec_150                  ;we are not, so keep going
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg

;reframe if too many ancillary data problems in succession

        TOO_MANY_DATA_ERRORS_DCD
        jmp     <_rdec_150

; We are here because the ancillary data decoded ok
; Decrement the number of ancillary data problem frames found.

_rdec_140
        sub     x1,b                        ;decrement the number of doof's
        tst     b       #0,x1               ;see if at the limit
        tlt     x1,b                        ;if less than zero, set to zero

_rdec_150
        move    b,y:doof                    ;save the current doof counter

        jclr    #PROTECT,y:<ctlflgs,_rdec_72  ;if no checksum, no reason to save
        jclr    #USE_SAVED,y:<ctlflgs,_rdec_72  ;did not use a saved frame

;do not reuse a saved frame

        bclr    #FRAME_SAVED,y:<ctlflgs ;clear we have a saved frame flag
        jmp     <top

_rdec_72

;since we had a good new frame, check controls for long solid operation
; restart the counter of frames with bit error
; and adjust count of framing retries, that control reset needed

        clr     b       #>1,y0              ;zero bit successive bit error counter
                                            ; & to decrement counter every frame
        move    y:frtries,a                 ;get framing try counter
        sub     y0,a    b,y:biterrs         ;decrement counter every frame
                                            ; & zero bit error counter
        tst     a                           ;see if counter reached zero
        jge     <_rdec_75                   ;if not, continue
        clr     a                           ;zero framing tries

_rdec_75
        move    a,y:frtries                 ;save the reduced framing tries ctr

        jmp     <top                        ;do next frame

_rdec_80
        OFF_MONO_LED_DCD                    ;turn off the mono led indicator
        OFF_JOINT_LED_DCD                   ;turn off the joint stereo led indicator
```

```
        OFF_STEREO_LED_DCD              ;turn off the stereo led indicator
        SET_LEDS_DCD                    ;set the leds as needed
        INTERRUPT_HOST_DCD

;mute the current frame

        jsr     <muteout                ;mute the output buffer
        jmp     <top

        end     start
```

```
        opt     fc
;
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;
; \URDCDSYN\getsbits.asm: Ben's mux

        title   'Get SB bits'

; This routine is used to get the SB bits of each of the sub-bands.

; on entry
;       r0 = address of the bit SB array
;       r1 = address of the SubBandIndex array
;
;       r6 = current offset in the input array
;       n6 = base address of the input array
;       y:<maxsubs = MAXSUBBANDS at sampling rate and bit rate
;       y:sc = shift count of current input word
;       x:crcbits = accumulator of bits covered by CRC-16 routine
;                       (bit coded for SBits are accumulated)

; on exit
;       r6 = updated
;       y:sc = updated
;
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'

        org     phe:

;initialize:
;  a. number of frame bits for a sub-band SBits index value
;  b. n0 offset for right channel sub-band SBIts values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;  c. n1 offset for right channel sub-band bit allocation values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;
getsbits
        move    #NSBITS,n4                      ;set number of bits to get
        move    #NUMSUBBANDS,n0                 ;SBits offset-right channel
        move    #NUMSUBBANDS,n1                 ;bit alloc offset-right channel
        move    x:crcbits,r5                    ;get CRC-16 bit counter
        move    n4,n5                           ;to accumulate CRC-16 bits
;
;loop through the sub-bands extracting the left and right (if applicable)
;SBit values values (y:<maxsubs = fixed count of sub-bands framed):
; process the right channel:
;  a. for current sub-band get the left channel allocation index value
```

```
;  b. if the left channel index is zero, go to insert a zero SBits value
;  c. otherwise, extract the SBits value for left channel of current sub-band
;     and go to insert value into the SBits array
;
        do      y:<maxsubs,_gets_90
        move    x:(r1),b                        ;get left index for subband
        tst     b                               ;test index for not coded (0)
        jeq     _gets_10                        ;use value of zero if not
        jsr     getvalue                        ;get a sb value
        move    #>MASKNSBITS,x1                 ;mask for sbits from getvalue
        and     x1,a    (r5)+n5                 ;mask off hi order one's
                                                ; & accum bits for CRC-16 rtn
        jmp     _gets_20                        ;go to store SBits value
;
;insert 0 for the left channel SBits value for this sub-band
;
_gets_10
        clr     a                               ;no index use zero
;
;move the left channel SBits value to the SBits array
;
_gets_20
        move    a1,x:(r0)
;
;process the right channel:
;  a. for current sub-band get the right channel allocation index value
;  b. if the right channel index is zero, go to insert a zero SBits value
;  c. otherwise, extract the SBits value for right channel of current sub-band
;     and go to insert value into the SBits array
;
        move    x:(r1+n1),b                     ;get right index for subband
        tst     b                               ;test index for not coded (0)
        jeq     _gets_30                        ;use value of zero if not
        jsr     getvalue                        ;get a sb value
        move    #>MASKNSBITS,x1                 ;mask for sbits from getvalue
        and     x1,a    (r5)+n5                 ;mask off hi order one's
                                                ; & accum bits for CRC-16 rtn
        jmp     _gets_40                        ;go to store SBits value
;
;insert 0 for the right channel SBits value for this sub-band
;
_gets_30
        clr     a                               ;no index use zero
;
;move the right channel SBits value to the SBits array
;increment SBits array and bit allocation index arrays for next sub-band
;
_gets_40
        move    a1,x:(r0+n0)
        move    (r0)+
        move    (r1)+

_gets_90
        move    r5,x:crcbits            ;store updated CRC-16 bit counter

        rts
```

```
        opt     fc,mex
;
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;
; \URDCDSYN\getskf.asm: Ben's mux

        title   'Get Scale Factors'

; This routine is used to get the scale factors of each of the sub-bands.

; on entry
;       r0 = address of the bit scale factor array (x memory)
;       r1 = address of the bit SB array (x memory)
;       r2 = address of the bit SubBandIndex array (x memory)
;
;       r6 = current offset in the input array
;       n6 = base address of the input array
;       y:<maxsubs = MAXSUBBANDS at sampling rate and bit rate
;       y:sc = shift count of current input word

; on exit
;       r6 = updated
;       y:sc = updated
;
;       a = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'
        include 'box_ctl.asm'

        org     phe:

getskf

;initialize:
;  number of frame bits for a sub-band scale factor index value

        move    #SKF,n4                         ;set number of bits to get
        move    #0,n0                           ;scale facts offset-left chan

;test the scale factors for certain tolerances:
;  a. zero scale factor is equivalent to a bit error,
;       indicate NO zero scale factor
;  b. clear the channel overload led indicators

        bclr    #SKF_ZERO,y:<ctlflgs
        OFF_LEFT_OVER_LED_DCD
        OFF_RIGHT_OVER_LED_DCD

;
;loop through the sub-bands extracting the left and right (if applicable)
;scale factor index values (y:<maxsubs = fixed count of sub-bands framed):
;within the sub-band loop is a loop for both channels: left then right
```

```
;
; process the left channel:
;  a. n0 offset for left channel sub-band scale factor index values:
;       left channel from 0 to (NUMSUBBANDS*NPERGROUP - 1)
;       right channel from NUMSUBBANDS*NPERGROUP
;                              to ((2 * NUMSUBBANDS*NPERGROUP) - 1)
;  b. n1 offset for left channel sub-band SBIts values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;  c. n2 offset for left channel sub-band bit allocation values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;
        do      y:<maxsubs,_gets_90
        move    #0,n1                           ;SBits offset-left channel
        move    #0,n2                           ;bit alloc offset-left channel
        bclr    #LEFT_vs_RIGHT,y:<ctlflgs       ;left is current channel
;
;process a channel for the current sub-band: 1st left then right
; a. update the register pointer with the offset into the scale factor
;       index array for the left or right channel
; b. get the bit allocation for the proper channel to see if any factors at all
;
        do      #NUMCHANNELS,_gets_80
        move    (r0)+n0                         ;offset for proper channel
        move    x:(r2+n2),a                     ;get the SubBandIndex[SubBand]
;
; first check if sub-band contains anything to work on.  This value could
; be zero if there is no energy in the sub-band.
;
        tst     a       x:(r1+n1),a             ;see if any alloted bits
        jne     _gets_05                        ;there were
;
; no bits were allocated, so set the scale factors to 63.  I could just
; set the scale factors to anything for this case, but I set them to the
; lowest (acutlly, 63 is one lower than the lowest) scale factor.
;
        move    #>63,a1                         ;get lowest scale factor value
        move    a1,x:(r0)+
        move    a1,x:(r0)+
        move    a1,x:(r0)+
        jmp     _gets_40

_gets_05
        tst     a       #>1,x0                  ;SB == 0 for this sub-band
                                                ; set x0 to sbit code '01'
        jne     _gets_10

; sbit code '00' case where must get all 3 scale factors

        do      #3,_gets_a
        jsr     getvalue
        move    #>MASKSKF,x1                    ;mask for scale factor hi ord
        and     x1,a                            ;mask off high order one's
        move    a1,x:(r0)+                      ;save in SubBandSKFs[SubBand][2]

_gets_a
        jmp     _gets_40

_gets_10
```

```
        cmp     x0,a      #>3,x0              ;SB == 1 for this sub-band
                                              ; set x0 to sbit code '11'
        jne     _gets_20

; sbit code '01' case where must get the second two scale factors

        jsr     getvalue                      ;get SubBandSKFs[SubBand][1]
        move    #>MASKSKF,x1                  ;mask for scale factor hi ord
        and     x1,a                          ;mask off high order one's
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][0]
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][1]
        jsr     getvalue                      ;get SubBandSKFs[SubBand][2]
        move    #>MASKSKF,x1                  ;mask for scale factor hi ord
        and     x1,a                          ;mask off high order one's
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][2]

        jmp     _gets_40

_gets_20
        cmp     x0,a      #>2,x0              ;SB == 3 for this sub-band
                                              ; set x0 to sbit code '10'
        jne     _gets_30

; sbit code '11' case where must get the first two scale factors

        jsr     getvalue                      ;get SubBandSKFs[SubBand][0]
        move    #>MASKSKF,x1                  ;mask for scale factor hi ord
        and     x1,a                          ;mask off high order one's
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][0]
        jsr     getvalue                      ;get SubBandSKFs[SubBand][1]
        move    #>MASKSKF,x1                  ;mask for scale factor hi ord
        and     x1,a                          ;mask off high order one's
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][1]
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][2]

        jmp     _gets_40

_gets_30
        cmp     x0,a                          ;SB == 2 for this sub-band
        jne     _gets_40

; sbit code '10' case where must get the first factor

        jsr     getvalue                      ;get SubBandSKFs[SubBand][0]
        move    #>MASKSKF,x1                  ;mask for scale factor hi ord
        and     x1,a                          ;mask off high order one's
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][0]
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][1]
        move    a1,x:(r0)+                    ;save in SubBandSKFs[SubBand][2]
;
;set up for the right channel:
;  a. backup the SKFs array for the left channel 3 scale factors indices
;  b. n0 offset for right channel sub-band scale factor index values:
;       left channel from 0 to (NUMSUBBANDS*NPERGROUP - 1)
;       right channel from NUMSUBBANDS*NPERGROUP
;                       to ((2 * NUMSUBBANDS*NPERGROUP) - 1)
;  c. n1 offset for right channel sub-band SBIts values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
```

```
;  d. n2 offset for right channel sub-band bit allocation values:
;       left channel from 0 to (NUMSUBBANDS - 1)
;       right channel from NUMSUBBANDS to ((2 * NUMSUBBANDS) - 1)
;
_gets_40

;back up for the 3 scale factors and while doing it test for:
;   a. zero scale factor
;   b. overload scale factor

        move    y:fade,y1                       ;get current fade value

        do      #NPERGROUP,_gets_40_e
        move    x:-(r0),a

        add     y1,a     #>63,y0                ;apply scale factor fade
                                                ; & set maximum scale factor
        tst     a        #>OVERLOAD_SKF,x0
        jne     _gets_40_a
;       bset    #SKF_ZERO,y:<ctlflgs            ;1/4/94 do not set bit error
        move    y0,a                            ;1/4/94 set scale factor to 63
        jmp     _gets_40_d

; test for an overload, and if so, set channel led

_gets_40_a
        cmp     x0,a
        jge     _gets_40_c                      ;NO overload, test for max

;overload sensed, set which channel led

        jset    #LEFT_vs_RIGHT,y:<ctlflgs,_gets_40_b
        ON_LEFT_OVER_LED_DCD
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg
        jmp     _gets_40_c                      ;test for max SKF

_gets_40_b
        ON_RIGHT_OVER_LED_DCD
;!!!dbg
        nop
        nop
        nop
        nop
        nop
;!!!dbg

_gets_40_c
        cmp     y0,a                            ;test if greater 63
        jle     _gets_40_d                      ;if less or eq, use current
        move    y0,a                            ;if so, set to 63

_gets_40_d
        move    a,x:(r0)                        ;restore scale factor
```

```
_gets_40_e
        bset    #LEFT_vs_RIGHT,y:<ctlflgs              ;indicate current channel
        move    #NUMSUBBANDS*NPERGROUP,n0              ;scale facts offset-right chan
        move    #NUMSUBBANDS,n1                        ;SBits offset-right channel
        move    #NUMSUBBANDS,n2                        ;bit alloc offset-right channel
;
;after processing the right channel, set up for the left channel of the
;  next sub-band:
; a. reincrement r0 for scale factor array by 3 for the inserted 3 factors
; b. to reposition the scale factor index array from right back to left channel
;    we put the negative offset in n0
; c. increment the SBits value array for the next sub-band
; d. increment the bit allocation index array for the next sub-band
;
_gets_80
        move    #3,n0
        move    (r1)+
        move    (r2)+
        move    (r0)+n0
        move    #-NUMSUBBANDS*NPERGROUP,n0             ;scale facts offset-right chan
_gets_90

        SET_LEDS_DCD                                   ;show overload conditions

        rts
```

```
        opt     fc,mex
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\getsws.asm

        title   'Get decoder external switch settings'

; This routine is used to interpret the external switches on the box
;
; on exit
;       x:tstrate = raw bit rate input from the switches
;       x:tstsel1 = raw application of line 1 select switch
;       x:tstsel2 = raw application of line 2 select switch
;       x:tstfrmt = frame communication formatting
;       x:tstreed = Reed/Solomon encoding switch
;       x:tstbaud = raw ancillary data baud rate input from the switches
;
;       y:<not_appl = bit 4 set if any switches changed
;
; destroyed:
;       register a

        include 'def.asm'
        include 'box_ctl.asm'

        section highmisc
        xdef    select1                 ;current setting of line 1 select switch
        xdef    select2                 ;current setting of line 2 select switch
        xdef    tstrate,tstsel1,tstsel2,tstfrmt,tstreed,tstbaud,tstmeth

        org     xhe:
stgetsws_xhe

select1         ds      1       ;current setting of line 1 select switch
select2         ds      1       ;current setting of line 2 select switch
tstrate         ds      1       ;raw bit rate input from the switches
tstsel1         ds      1       ;raw application of line 1 select switch
tstsel2         ds      1       ;raw application of line 1 select switch
tstfrmt         ds      1       ;raw frame comminucation formatting
tstreed         ds      1       ;Reed/Solomon encoding switch
tstbaud         ds      1       ;raw ancil data baud rate input from switches
tstmeth         ds      1       ;raw code for diagnostic vs normal operation

endgetsws_xhe
        endsec

        org     phe:

getsws

        bclr    #4,y:<not_appl  ;indicate no changes initially

        clr     a
        move    a,x:tstrate
        move    a,x:tstsel1
        move    a,x:tstsel2
        move    a,x:tstfrmt
        move    a,x:tstreed
        move    a,x:tstbaud
```

```
        move    a,x:tstmeth

;check the dip switches to determine frame bit rate
;  and ancillary data application and data baud rate

;switches for framing bit rate

        GET_BIT_RATE_DCD

;switches for framing type code and mono output

        GET_FRAME_TYPE_DCD

;switches to set if selecting line 1 and/or line 2

        GET_SELECTED_LINES_DCD

;switches for ancillary data baud rate

        GET_BAUD_RATE_DCD

;switches for method of operation, normal audio or diagnostics

        GET_DIAGNOSTICS_DCD

        move    x:tstrate,y1            ;look for a change in framing rate
        move    y:rawrate,a
        cmp     y1,a    x:tstsel1,y1    ;set up to test line 1 selection
        jne     _gsws_80
        move    x:select1,a
        cmp     y1,a    x:tstsel2,y1    ;set up to test line 2 selection
        jne     _gsws_80
        move    x:select2,a
        cmp     y1,a    x:tstfrmt,y1    ;set up to test framing format
        jne     _gsws_80
        move    y:frmformat,a
        cmp     y1,a    x:tstreed,y1    ;set up to test Reed/Solomon switch
        jne     _gsws_80
        move    y:reedsolomon,a
        cmp     y1,a    x:tstbaud,y1    ;set up to test ancillary data baud
        jne     _gsws_80
        move    y:baudrte,a
        cmp     y1,a
        jne     _gsws_80

;see if we have to switch from normal to the diagnostic method of operation

        move    x:tstmeth,a             ;get the diag nostic code
        tst     a                       ;see if other than normal operation
        jeq     _gsws_90                ;normal operation, continue

_gsws_80
        bset    #4,y:<not_appl          ;indicate changes in external switches

_gsws_90
        rts
```

BAD ORIGINAL

```
        opt     fc,mex
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\getsync.asm: Ben's mux

        title   'Get Sync'

; This routine gets the sync word.

; on exit
;       a1 = right justified sync value padded on right with zeros
;       r6 = updated
;       y:sc = updated
;
;       a2 = destroyed
;       a1 = destroyed
;       b = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r4 = destroyed
;       n4 = destroyed

        include 'def.asm'

        org     phe:

getsync
        move    #NSYNC,n4                       ;number of bits

        jsr     getvalue                        ;get sync right justified

        move    #>GETSYNCMSK,x1                 ;mask for sync word hi order
        and     x1,a                            ;mask off any high order 1's

        rts
```

```
        opt     fc
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\getsystd.asm: set led for MPEG-ISO vs old CDQ2000/CDQ1000

        title   'Get Syst'

; This routine decodes the MUSICAM frame header information.

; on exit
;       x:findidbit             1=high sample rate, 0=low sample rate
;       y:ctlflgs = updated     (PROTECT bit: 0=YES for checksum, 1=NO)
;                               (STEREO_vs_MONO bit: 0=stereo, 1=mono)
;                               (JOINT_FRAMING bit: 0=not, 1=joint)
;                               (SPLIT_MONO_FRAME bit: 0=no, 1=yes)
;       x:fndbit                bit rate code
;       x:fndsmpl               sampling rate code
;       y:bitsfrm               actual frame length in bits
;       x:padbit                0=frame not padded, 1=frame padded w 8 added bits
;       y:privacybit            privacy bit value in frame header
;       y:frmtype               stereo, joint stereo, dual mono or mono
;       y:sibound               joint stereo intensity boundary subband count
;       y:maxsubs               number of sub-bands encoded in BAL's
;       y:copyright             copyright bit value in frame header
;       y:original              original/home bit value in frame header
;       y:emphasis              emphasis value in frame header
;       x:AllwAdd               address of the Allowed table to use
;       x:skftbl                address of the BAL's bit table to use
;
;       a  = destroyed
;       b  = destroyed
;       x0 = destroyed
;       x1 = destroyed
;       y0 = destroyed
;       y1 = destroyed
;       r0 = destroyed
;       r1 = destroyed
;       r4 = destroyed              by getvalue call
;       n4 = destroyed

        include 'def.asm'
        include 'box_ctl.asm'

        org     phe:

getsyst

;decode the bits 0 thru 3 of the frame header:
;
;   bit  description
;  -----------------
;    0   high or low sampling rate:
;               1 = high rates 48, 44.1 and 32 K sampling rates
;               0 = low rates 24, 22.05 and 16 K sampling rates
;   1-2  MUSICAM Layer:
;               11 = Layer I
;               10 = Layer II
;               01 = Layer III
;    3   CRC-16 checksum frame header protection:
```

```
;               0 = checksum protection encoded after frame header
;               1 = NO checksum protection

        move    #NSYSTHDR_1,n4          ;get field #1 (bits 0-3 in hdr)
                                        ; bit 0 indicates protection checksum
                                        ;       0 = yes checksum included
                                        ;       1 = no checksum included
        jsr     getvalue                ;get data right justified
        move    #>MASKSYSTHDR_1,x1      ;mask for getvalue of header field 1
        and     x1,a    #NBITRATE,n4    ;mask off high order bits
                                        ; & set len of bit rate-bits 4-7 in hdr
        bset    #PRCTECT,y:<ctlflgs     ;default that CRC protection applies
        move    a1,y:<not_appl          ;see if CRC bit set indicating not appl
        jclr    #0,y:<not_appl,_gsyst_00  ;hdr shows zero, CRC is included
        bclr    #PRCTECT,y:<ctlflgs     ;set that CRC protection NOT applicable

_gsyst_00

; set the high or low sampling rate ID code

        bset    #0,x:fndidbit           ;default with high sample rate bit on
        jset    #3,y:<not_appl,_gsyst_01        ;if set for high, continue
        bclr    #0,x:fndidbit           ;reset to low sample rate bit on

_gsyst_01

;decode the bits 4 thru 7 of the frame header: bit rate

        jsr     getvalue                ;get bit rate code right justified
        move    #>MASKNBITRATE,x1       ;mask for getvalue of frame bit rate
        and     x1,a    y:spltrte,x1    ;mask off high order bits
                                        ; & get the 1/2 bit rate code
        move    a1,x:fndbit             ;save header bit rate code

;test for CDQ2000 split mode of transmission and check for a split mono frame

        bclr    #SPLIT_MONO_FRAME,y:<ctlflgs ;clear indication for split mono

        jclr    #SPLIT_MODE,y:<ctlflgs,_gsyst_05 ;test for split mode of trans

        move    a1,a                    ;clean up junk after getvalue
        cmp     x1,a                    ;see if frame rate same as split rate
        jne     _gsyst_05               ;if not, we should have a full frame

;since we matched bit rates, this must be a 1/2 bit rate in mono

        bset    #SPLIT_MONO_FRAME,y:<ctlflgs ;indicate for ancillary data

_gsyst_05

;decode the bits 8 and 9 of the frame header: sampling rate

        move    #NSAMPLERATE,n4         ;eat sampling rate
        jsr     getvalue                ;get sampling rate right justified
        move    #>MASKNSAMPLERATE,x1    ;mask for getvalue of data sampling rate
        and     x1,a    #NSYSTHDR_2,n4  ;mask off high order bits
                                        ; & set len field #2 (bits 10-11 in hdr)
        move    a1,x:fndsmpl            ;save the header sample rate

;decode the bits 10 and 11 of the frame header:
```

```
;   bit  description
;   -----------------
;   10   padding bit:
;             0 = frame is not padded
;             1 = frame is padded with 8 bits
;   11   privacy bit
;
;test the frame padded flag in header (bit 10) and update frame bit count

        jsr     getvalue                    ;get data right justified
        move    #>MASKSYSTHDR_2,x1
        and     x1,a    #>PAD_SLOT,x1       ;mask off high order bits
                                            ; & get the padded bits added to frame
        move    a1,y:<not_appl              ;see if frame padded bit set
        move    y:frmbits,a                 ;get the unpadded frame bit count
        bclr    #0,x:padbit                 ;default that the frame is not padded
        jclr    #1,y:<not_appl,_gsyst_06    ;if hdr bit not set, no padded bits
        bset    #0,x:padbit                 ;indicate padded bits
        add     x1,a                        ;add pad bits to frame bit count

_gsyst_06

;set the frame length in bits (normal or padded with 8 bits)
;set the frame privacy bit in header (bit 11)

        move    a,y:bitsfrm                 ;store actual frame bit count
        bclr    #0,y:privacybit             ;default the frame header privacy bit
        CLR_PRIVACY_BIT_DCD                 ;in decoder status
        jclr    #0,y:<not_appl,_gsyst_08
        bset    #0,y:privacybit             ;set the frame header privacy bit
        SET_PRIVACY_BIT_DCD                 ;in decoder status

_gsyst_08

;decode the bits 12 and 13 of the frame header: frame type
;   00 = FULL STEREO      (2 channels)
;   01 = JOINT STEREO     (2 channels)
;   10 = DUAL MONO        (2 channels)
;   11 = MONO             (1 channel)

        move    #NFRAMETYPE,n4              ;get frame type (bits 12-13 in hdr)
        jsr     getvalue                    ;get frame type right justified
        move    #>MASKFRAMETYPE,x1          ;mask for getvalue of framing type
        and     x1,a    #NSTINTENSITY,n4        ;mask off high order bits
                                            ; & get stereo intesity (bits 14-15)
        move    a1,y:frmtype                ;save type of frame

;set the default MAXSUBBANDS as for 2 channel frames

        move    #oldccs,r0                  ;to test if old CCS CDQ frames
        move    y:maxsubs_2,y1              ;default to 2 channel MAXSUBBANDS

; if the old CCS flag is set to decode from old CCS CDQ's, use mono MAXSUBBANDS

        jclr    #0,y:(r0),_gsyst_09         ;if MPEG-ISO, continue
        move    y:maxsubs_1,y1              ;default to MONO MAXSUBBANDS

_gsyst_09

;set the type of frame flag
```

```
        move    y:frmtype,a             ;get the frame type
        move    #>FULL_STEREO,x1
        cmp     x1,a    #>JOINT_STEREO,x1
        jne     _gsyst_10
        bclr    #STEREO_vs_MONO,y:<ctlflgs      ;indicate stereo samples
        bclr    #JOINT_FRAMING,y:<ctlflgs       ;clear joint stereo indicator
        jmp     _gsyst_40

_gsyst_10
        cmp     x1,a    #>DUAL,x1
        jne     _gsyst_20
        bclr    #STEREO_vs_MONO,y:<ctlflgs      ;indicate stereo samples
        bset    #JOINT_FRAMING,y:<ctlflgs       ;indicate stereo samples
        jmp     _gsyst_40

_gsyst_20
        cmp     x1,a
        jne     _gsyst_30                       ;dual channel is same as stereo
        bclr    #STEREO_vs_MONO,y:<ctlflgs      ;indicate stereo samples
        bclr    #JOINT_FRAMING,y:<ctlflgs       ;clear joint stereo indicator
        jmp     _gsyst_40

_gsyst_30
        bset    #STEREO_vs_MONO,y:<ctlflgs      ;indicate mono samples
        bclr    #JOINT_FRAMING,y:<ctlflgs       ;clear joint stereo indicator

;set the MAXSUBBANDS for MONO channel frames

        move    y:maxsubs_1,y1                  ;get to MONO MAXSUBBANDS

;if SPLIT_MONO_FRAME, use split frame mono MAXSUBBANDS

        jclr    #SPLIT_MONO_FRAME,y:<ctlflgs,_gsyst_40
        move    y:spltmaxsubs,y1                ;get to split MONO MAXSUBBANDS

_gsyst_40

;set the number of sub-bands encoded in the BAL's

        move    y1,y:<maxsubs           ;set the working MAXSUBBANDS for frame

; light led to indicate MPEG-ISO compatible frames
;       or old CCS CDQ2000/CDQ1000 non-conforming frames at low bit rates

        move    #oldccs,r0              ;to test if old CCS CDQ frames
        nop
        jclr    #0,y:(r0),_iso_led      ;if ISO, set led as ISO
        ON_MPEG_ISO_vs_CCS_LED_DCD      ;indicate old ccs frames
        jset    #1,y:(r0),_do_leds      ;if CDQ1000, set led as CCS
        jset    #STEREO_vs_MONO,y:<ctlflgs,_iso_led ;if MONO, ISO led
        move    #>SAM48K,x0             ;test for 48 K sampling
        move    #>SAM32K,x1             ;test for 32 K sampling
        move    #>BITRATE_56,y0         ;low bit rate code 56 K
        move    y:smplrte,a             ;to test sample rate code
        cmp     x0,a    #>BITRATE_96,y1 ;see if 48 K sampling
                                        ; & set hi bit rate 96 K @ 48
        jeq     _tst_bit                ;if 48, test bit rate range
        cmp     x1,a    #>BITRATE_160,y1 ;see if 32 K sampling
                                        ; & set hi bit rate 96 K & 32
```

```
        jne     _iso_led                        ;if not 32, set ISO led

_tst_bit
        move    y:bitrate,a                     ;check bit rate in the range
        cmp     y0,a                            ;test vs lowest ISO high code
        jlt     _iso_led                        ;if less, ISO led
        cmp     y1,a                            ;test vs highest ISO high code
        jle     _do_leds                        ;if less or equal, leave CCS led

_iso_led
        OFF_MPEG_ISO_vs_CCS_LED_DCD             ;indicate iso compatible frames

_do_leds
        SET_LEDS_DCD

;decode the bits 14 and 15 of the frame header:
;         mode extention (joint stereo intensity boundary)
;   00 = stereo for sub-bands 0 thru 3,  joint for sub-bands  4 and up
;   01 = stereo for sub-bands 0 thru 7,  joint for sub-bands  8 and up
;   10 = stereo for sub-bands 0 thru 11, joint for sub-bands 12 and up
;   11 = stereo for sub-bands 0 thru 15, joint for sub-bands 16 and up

        jsr     getvalue                        ;get data right justified
        move    #>MASKSTINTENSITY,x1            ;mask for getvalue of intensity bound
        and     x1,a    #BOUND_4,r0             ;mask off high order bits
                                                ; & set up for joint just in case
        jclr    #JOINT_FRAMING,y:<ctlflgs,_gsyst_90 ;intensity is meaningless

        move    a1,a                            ;clear off any junk
        move    #>INTENSITY_4,b                 ;get code for channels 4-31 intensity
        cmp     a,b     #>INTENSITY_8,b
        jeq     _gsyst_90

        cmp     a,b     #>INTENSITY_12,b
        jne     _gsyst_80                       ; not joint, intensity is meaningless
        move    #BOUND_8,r0
        jmp     _gsyst_90

_gsyst_80
        cmp     a,b     #BOUND_16,r0
        jne     _gsyst_90                       ; not joint, intensity is meaningless
        move    #BOUND_12,r0

_gsyst_90
        move    r0,y:sibound                    ;save intensity stereo sub-band bound

;decode the bits 16 thru 19 of the frame header:
;
;   bit  description
;  -----------------
;   16   copyright bit:
;               0 = no copyright
;               1 = protected by copyright
;   17   original/home bit:
;               0 = bitstream is a copy
;               1 = bitstream is an original
;  18-19 emphasis:
;               00 = no emphasis
;               01 = 50/15 microsec. emphasis
;               10 = reserved
```

```
;                   11 = CCITT J.17 emphasis

        move    #NSYSTHDR_3,n4          ;get field #3 (bits 16-19)
        jsr     getvalue                ;get data right justified

        move    #>MASKSYSTHDR_3,x1      ;to mask off unwanted bits
        and     x1,a                    ;mask off the unwanted bits
        move    a1,y:<not_appl          ;move to addr to be tested
        clr     a                       ;to restore y:<not_appl as all 0's

;set the copyright bit, original/home bit and emphasis code from header

        bclr    #0,y:copyright          ;default bit as not set
        CLR_COPYRIGHT_BIT_DCD           ;in decoder status
        jclr    #3,y:<not_appl,_gsyst_91        ;if bit 16 not set, continue
        bset    #0,y:copyright          ;set the copyright bit
        SET_COPYRIGHT_BIT_DCD           ;in decoder status

_gsyst_91
        bclr    #0,y:original           ;default bit as not set
        CLR_ORIGINAL_BIT_DCD            ;in decoder status
        jclr    #2,y:<not_appl,_gsyst_92        ;if bit 17 not set, continue
        bset    #0,y:original           ;set the original/home bit
        SET_ORIGINAL_BIT_DCD            ;in decoder status

_gsyst_92
        move    a,y:emphasis            ;zero the emphasis code
        CLR_EMPHASIS_BIT_0_DCD          ;in decoder status
        CLR_EMPHASIS_BIT_1_DCD          ;in decoder status
        jclr    #1,y:<not_appl,_gsyst_93        ;if bit 18 not set, try bit 19
        bset    #1,y:emphasis           ;set bit 1 of emphasis code
        SET_EMPHASIS_BIT_1_DCD          ;in decoder status

_gsyst_93
        jclr    #0,y:<not_appl,_gsyst_94        ;if bit 19 not set, finish up
        bset    #0,y:emphasis           ;set bit 0 of emphasis code
        SET_EMPHASIS_BIT_0_DCD          ;in decoder status

_gsyst_94

;restore y:<not_appl to all zeros

        move    a,y:<not_appl           ;reset the dummy variable

;Set the proper Allowed table and BAL's bit table addresses:
;test for low sampling rate Allowed table

        move    #smplidbit,r0           ;addr of frame header ID bit (0 = low)
        nop
        jset    #0,y:(r0),_gsyst_95     ;if high rate, select Allowed table

        move    #Allowed_3,r0           ;addr of low sampling allowed table
        move    #skftbl_3,r1            ;addr of low sampling BAL's bit table
        jmp     _gsyst_100              ;go to store Allowed table address

_gsyst_95

;Set the proper Allowed table address based on working MAXSUBBANDS (y:<maxubs)
; if less than 27, used table 2
```

```
        move    y:<maxsubs,x0              ;get current MAXSUBBANDS
        move    #>27,a                     ;to see which of 2 tables applies
        move    #skftbl_1,r1               ;addr of high sampling BAL's bit table
        cmp     x0,a     #Allowed_1,r0     ;see if need the low bit rate table
                                           ; & set up as regular Allowed table
        jle     _gsyst_100                 ;regular Allowed table applies

;select the lower bit rate Allowed table

        move    #Allowed_2,r0
        move    #skftbl_2,r1               ;addr of high sampling BAL's bit table

_gsyst_100

;set the address of the selected Allowed table
;set the address of the selected BAL's bit table

        move    r0,x:AllwAdd
        move    r1,x:skftbl

        rts
```

```
        opt     fc
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; \URDCDSYN\synth.asm

        title   'Synthesize a group of sample and output audio'

;synth.asm: this is the main of the poly synthesis routine
;   it handles a new group of samples to be decoded and inverse quantized
;   for stereo a group of samples contains 192 samples (96 left & 96 right)
;   if mono a group of samples contains 96 samples only

        include 'def.asm'
        include 'box_ctl.asm'

        section highmisc
        xdef    dualchan
        xdef    synthN6Save

        org     yhe:
stsynth_yhe

dualchan        ds      1               ;control for channel swap ctls
synthN6Save     ds      1               ;instead of ssh
                                        ;bit 0 = 1 means copy left to right
                                        ;bit 1 = 1 means copy right to left
                                        ;bit 2 = 1 means swap left & right
                                        ;bit 3 = 1 means mute both left & right

endsynth_yhe
        endsec

        org     phe:

synth
        move    #dualchan,r0                    ;set addr of two chan ctls
        move    #ASMData,r1                     ;position to left channel

;see if the frame is to be muted

        jclr    #MUTE_LEFT_and_RIGHT,y:(r0),_synt_00

;set the number of words in both channels for the MUTE do loop

        move    #NUMSUBBANDS*NPERGROUP*2,n0     ;2 channels numb words to mute
        move    #0,n1                           ;hold position at left channel
        jmp     _synt_20                        ; go to the mute loop

_synt_00

;if a stereo frame, checkout for special mute or swaps

        jclr    #STEREO_vs_MONO,y:<ctlflgs,_synt_40

        move    #NUMSUBBANDS*NPERGROUP,n1       ;spacing to right channel
        move    r1,r0                           ;position to left channel
        move    (r1)+n1                         ;addr of right channel

;copy the left into right
```

```
        do      #NUMSUBBANDS*NPERGROUP,_synt_05
        move    x:(r0)+,x0                  ;get left channel value
        move    x0,x:(r1)+                  ;put left value into right
_synt_05

;if we do not have to mute a channel (mono to both),
;   skip ahead to restore registers used

        jset    #MONO_OUT_BOTH,y:<ctlflgs,_synt_90 ;out to both, go restore regs

;set the number of words in one channel for the mute do loop

        move    #NUMSUBBANDS*NPERGROUP,n0       ;1 channel numb words to mute

;set up to mute the channel not selected for mono output

        move    #ASMData,r1                 ;position to left channel
        move    #0,n1                       ;start at left channel

;if not the left channel for output, continue
;   else, position to the right channel for muting

        jset    #MONO_OUT_CHANNEL,y:<ctlflgs,_synt_20   ;if right, zero left
        move    #NUMSUBBANDS*NPERGROUP,n1       ;else, zero the right channel
_synt_20

;mute the proper channel(s)

        move    #0,x0                       ;to mute the channel
        move    (r1)+n1                     ;addr of channel to mute

        do      n0,_synt_30
        move    x0,x:(r1)+                  ;zero value in chosen channel
_synt_30
        jmp     _synt_90                    ;do the polysynthesis
_synt_40

;see if the two channel frame requires any swapping:
;       swap left and right
;       left into right
;       right into left

        jclr    #SWAP_LEFT_and_RIGHT,y:(r0),_synt_50

;swap the left and right channels

        move    #NUMSUBBANDS*NPERGROUP,n1       ;spacing to right channel
        move    r1,r0                       ;position to left channel
        move    (r1)+n1                     ;addr of right channel

;copy the left into right

        do      #NUMSUBBANDS*NPERGROUP,_synt_45
        move    x:(r0),x0                   ;get left channel value
        move    x:(r1),x1                   ;get right channel value
```

```
        move    x0,x:(r1)+                          ;put left value into right
        move    x1,x:(r0)+                          ;put right value into left

_synt_45
        jmp     _synt_80                            ;go see if any channel mutes

_synt_50

;see if a copy the left into the right

        jclr    #COPY_LEFT_to_RIGHT,y:(r0),_synt_60  ;if not copy left to right

;copy the left channel into the right channel

        move    #NUMSUBBANDS*NPERGROUP,n1           ;spacing to right channel
        move    r1,r0                               ;position to left channel
        move    (r1)+n1                             ;addr of right channel
        jmp     _synt_70                            ;do the copy

_synt_60

;see if a copy the right into the left

        jclr    #COPY_RIGHT_to_LEFT,y:(r0),_synt_80  ;if not copy right to left

;copy the right channel into the left channel

        move    #NUMSUBBANDS*NPERGROUP,n0           ;spacing to right channel
        move    r1,r0                               ;position to left channel
        nop
        move    (r0)+n0                             ;addr of right channel

_synt_70

;copy the one channel into the other

        do      #NUMSUBBANDS*NPERGROUP,_synt_80
        move    x:(r0)+,x0                          ;get source channel value
        move    x0,x:(r1)+                          ;put source value into destin

_synt_80

;see if either channel is to be muted

        jmp     _synt_05

_synt_90

;pass both channels to the polysynthesis routine

        move    #ASMData,r0

        move    n6,y:synthN6Save                    ;save
        move    #1023,m2                            ;set to be a mod(1024) buffer
        move    m2,m3                               ;set to be a mod(1024) buffer
        move    #32,n0                              ;set scale factor

        jsr     polysynt

        move    y:synthN6Save,n6                    ;restore n6
```

```
        move    y:linear,m1                     ;restore to linear addressing
        move    m1,m2                           ;restore to linear addressing
        move    m1,m3                           ;restore to linear addressing
        move    m1,m5                           ;restore to linear addressing

        rts
```

```
;
; (c) 1991. Copyright Corporate Computer Systems, Inc. All rights reserved.
;
; c:\musicam\dsp\acorn\urdcdsyn\translte.asm
        include '..\ultma\translte.asm'
```

CLAIMS

What is claimed is:

1. An audio transmission system comprising:

a coder for coding an input audio signal into a digital signal to be transmitted through a traditional analog telephone network, the digital signal having a transmission rate of 28.8 kilobits per second or less; and

a decoder for decoding the digital signal that is received form the telephone network to provide an output audio signal with a frequency range greater than 4 kilohertz.

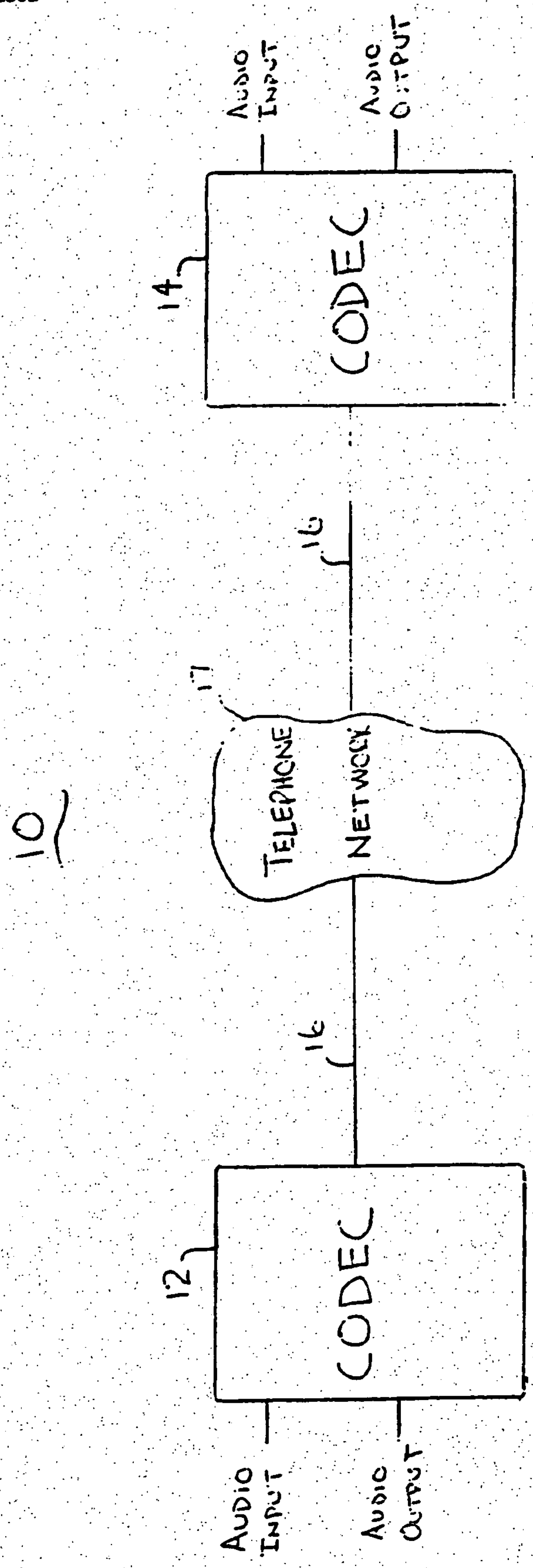

10
Audio Input
Audio Output
CODEC
14
16
17
Telephone Network
16
CODEC
12
Audio Input
Audio Output

Fig. 1

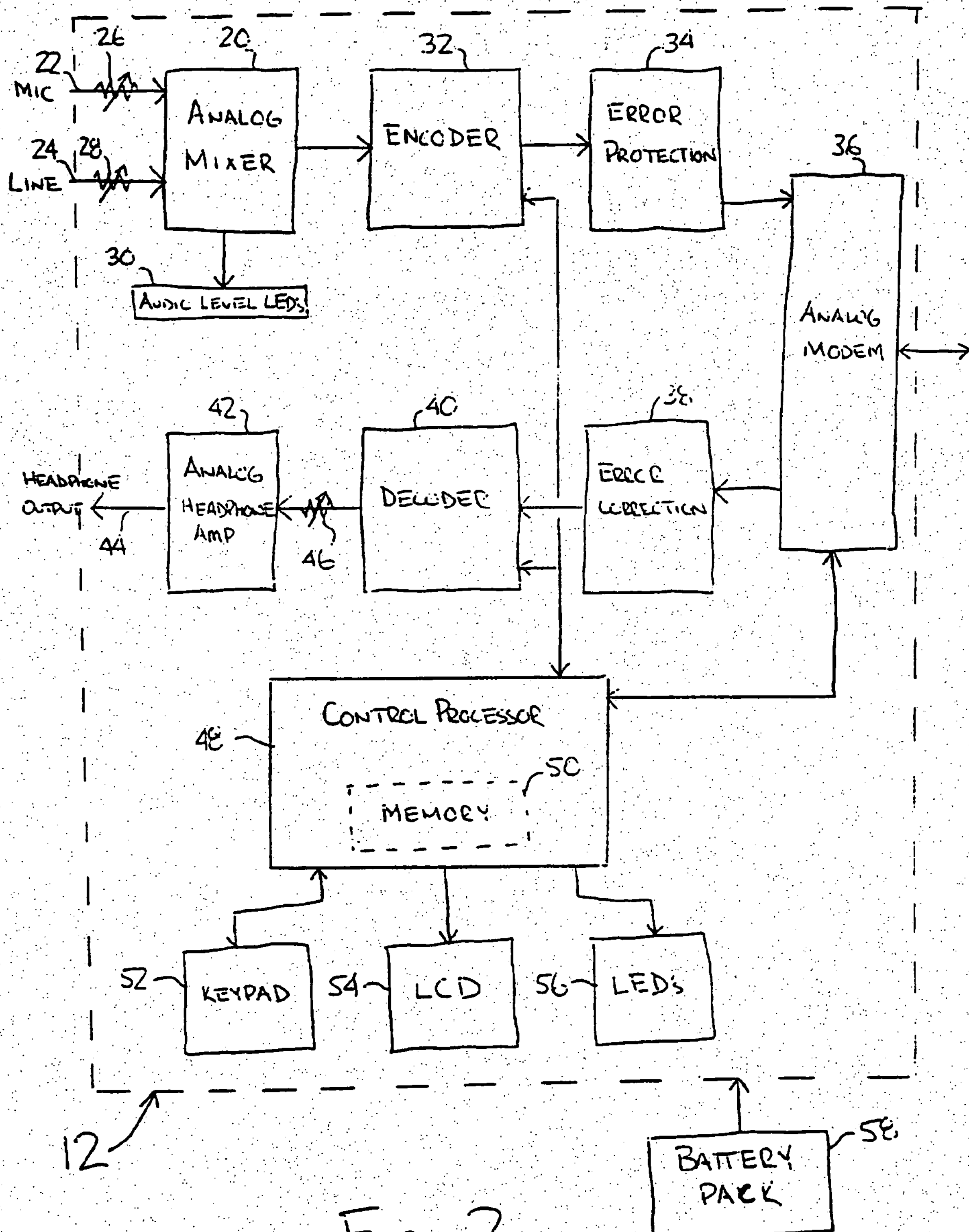
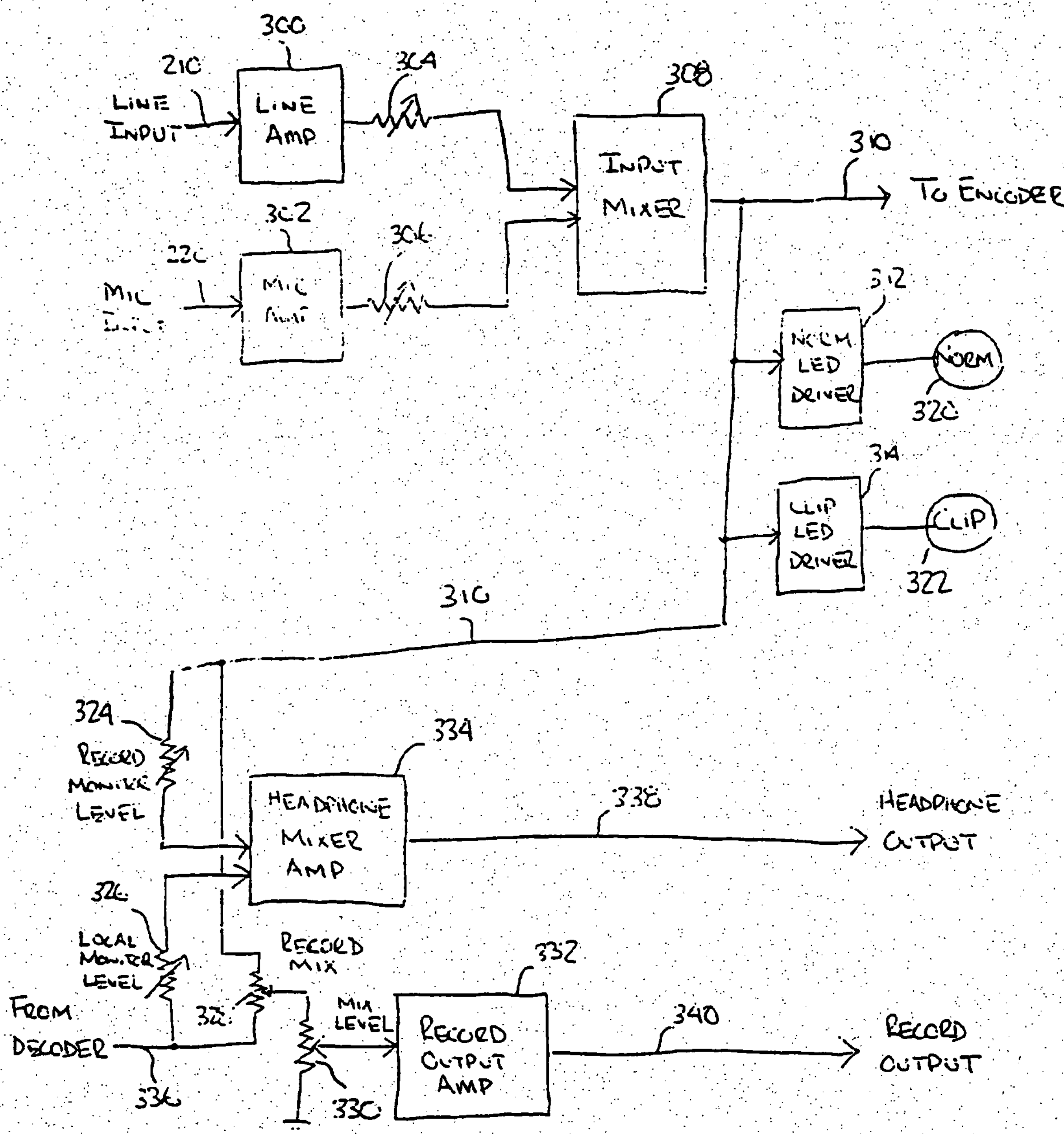

22
MIC
26
24
LINE
28
20
ANALOG MIXER
30
AUDIO LEVEL LEDS
32
ENCODER
34
ERROR PROTECTION
36
ANALOG MODEM
38
ERROR CORRECTION
40
DECODER
42
ANALOG HEADPHONE AMP
46
HEADPHONE OUTPUT
44
48
CONTROL PROCESSOR
50
MEMORY
52
KEYPAD
54
LCD
56
LEDS
12
BATTERY PACK
58

Fig. 2



300
210
304
308
LINE INPUT
LINE AMP
INPUT MIXER
310
TO ENCODER
302
220
306
MIC INPUT
MIC AMP
312
NORM LED DRIVER
NORM
320
314
CLIP LED DRIVER
CLIP
322
316
324
RECORD MONITOR LEVEL
334
HEADPHONE MIXER AMP
338
HEADPHONE OUTPUT
326
LOCAL MONITOR LEVEL
RECORD MIX
332
FROM DECODER
328
MIX LEVEL
RECORD OUTPUT AMP
340
RECORD OUTPUT
336
330

Fig. 3

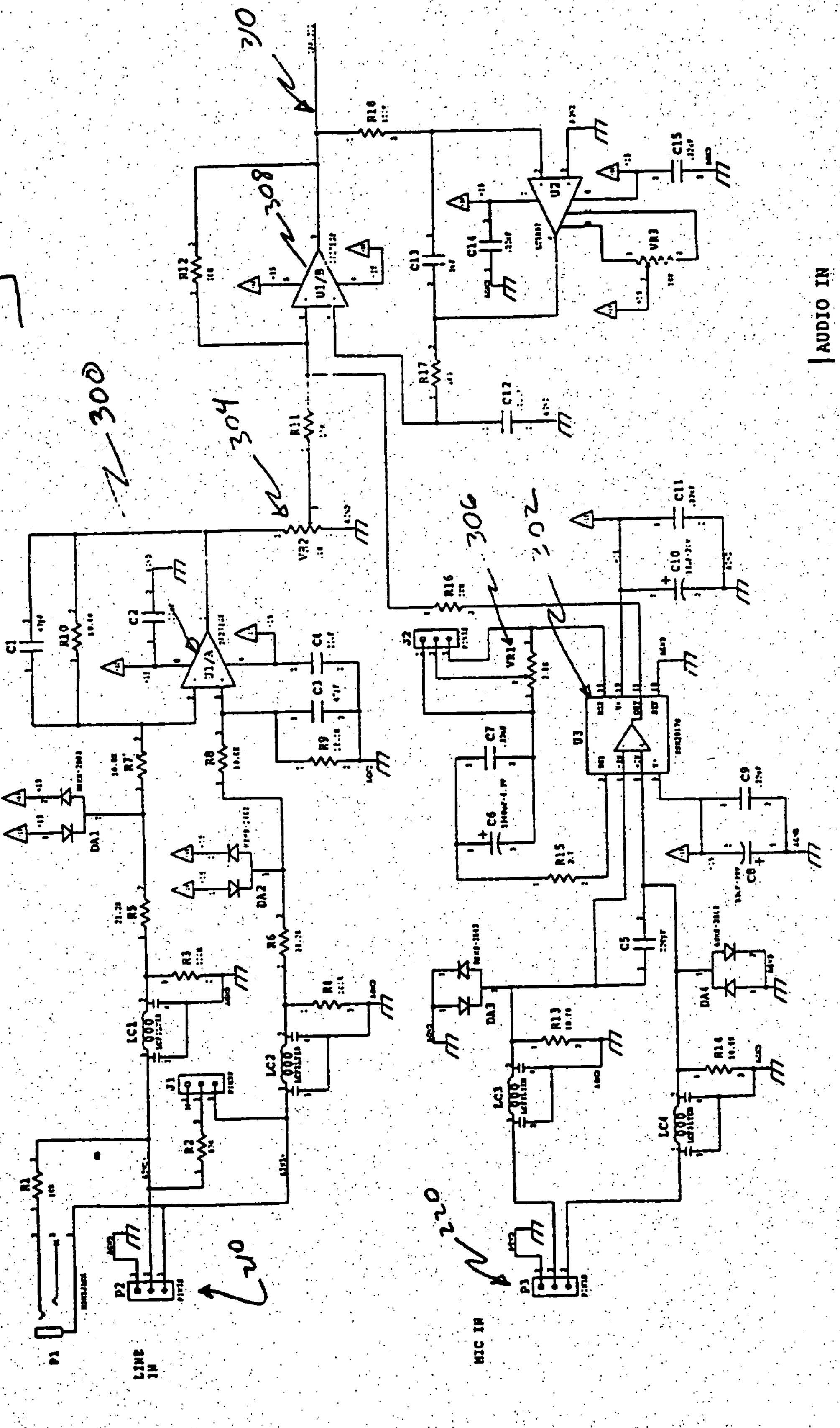

AUDIO IN
LINE IN
MIC IN
310
308
300
304
306
202
210
220
U1/B
U1/A
U2
U3
R1
R2
R3
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
VR1
VR2
VR3
LC1
LC2
LC3
LC4
DA1
DA2
DA3
DA4
J1
J2
P1
P2
P3

Fig. 4

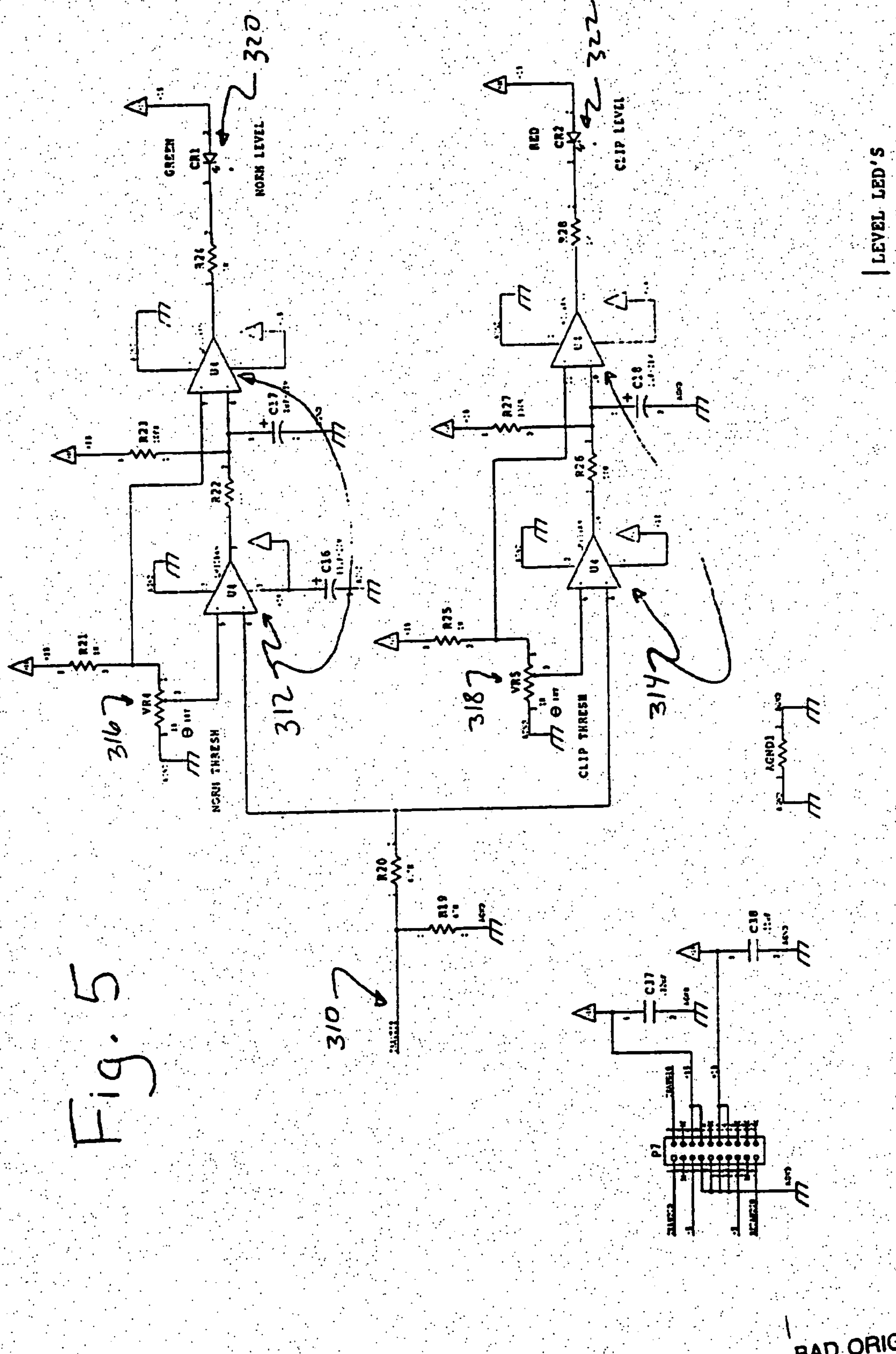

320
322
GREEN
CR1
NORM LEVEL
RED
CR2
CLIP LEVEL
LEVEL LED'S
R24
R28
R23
R27
R22
R26
R21
R25
C16
C17
C18
U4
VR4
VR5
NORM THRESH
CLIP THRESH
316
312
318
314
R20
R19
310
AGND1
C37
C38
P7

Fig. 5

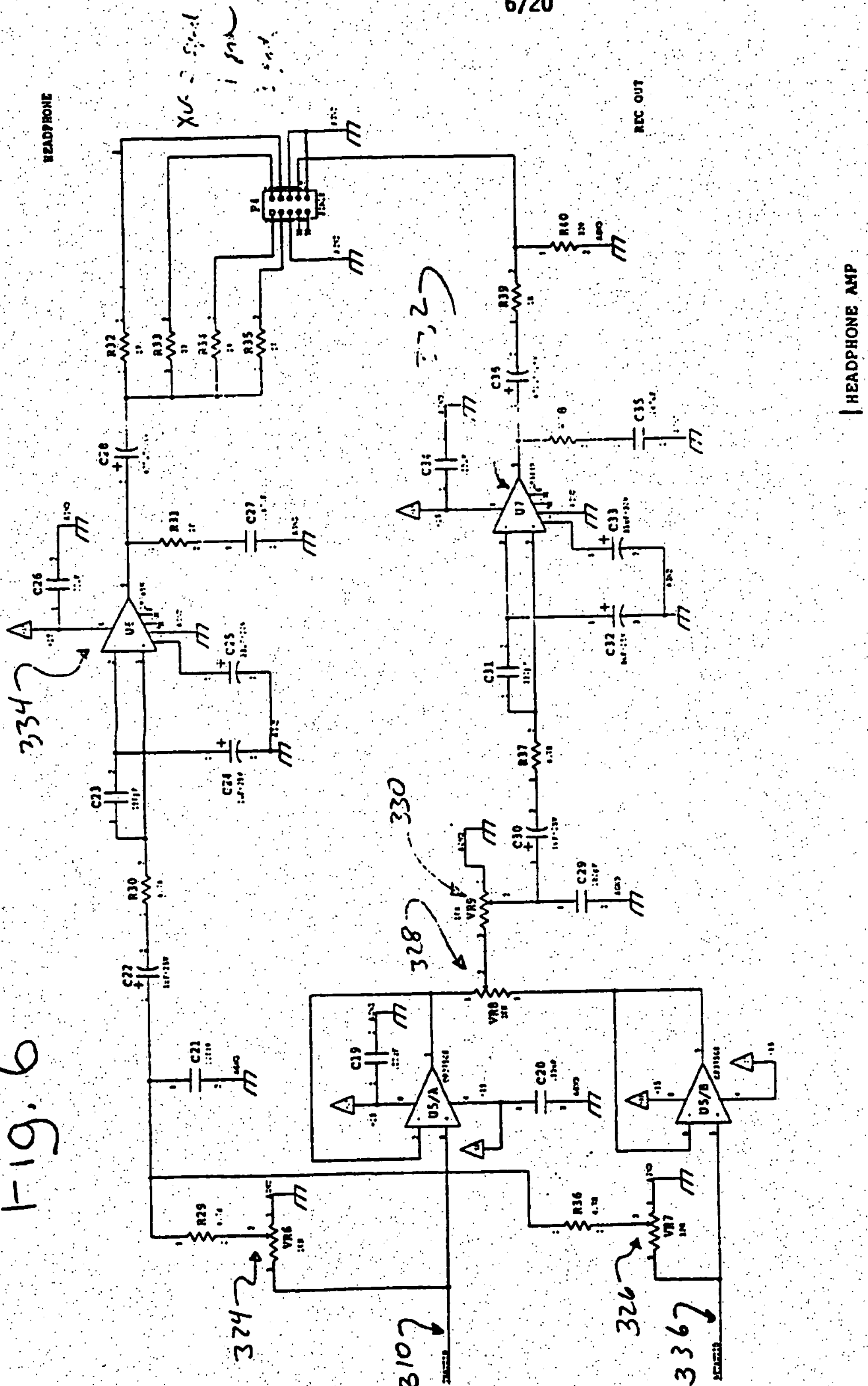

HEADPHONE
REC OUT
HEADPHONE AMP
P1
U6
U7
U5/A
U5/B
VR5
VR6
VR7
VR8
R29
R30
R31
R32
R33
R34
R35
R36
R37
R39
R40
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
C36
334
330
328
324
310
326
336

Fig. 6

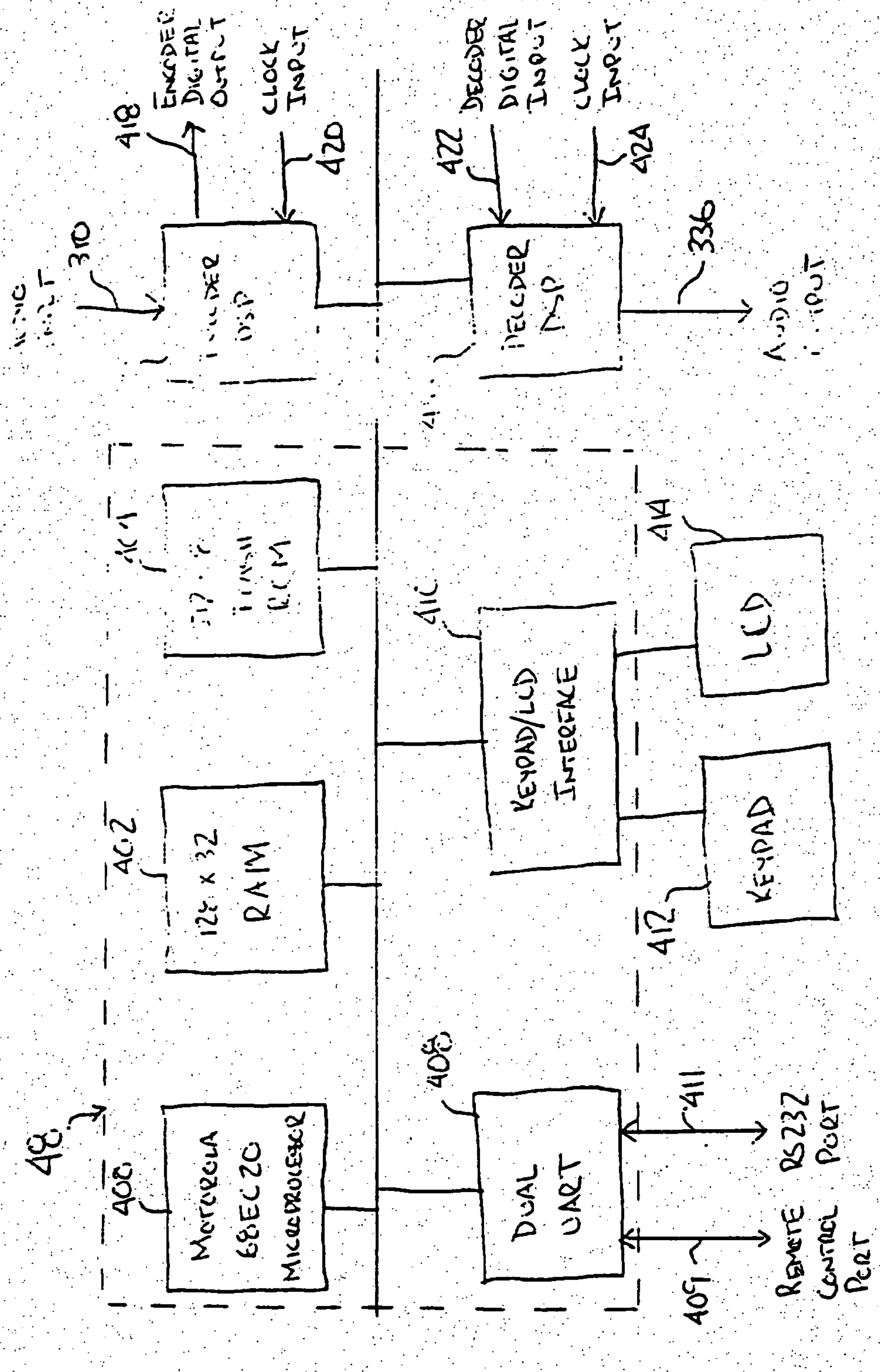

Encoder Digital Output
Clock Input
418
420
Decoder Digital Input
Clock Input
422
424
Decoder DSP
336
Audio Output
310
48
400
Motorola 68EC020 Microprocessor
128 x 32 RAM
Keypad/LCD Interface
LCD
414
Keypad
412
408
Dual UART
411
RS232 Port
409
Remote Control Port

Fig 7

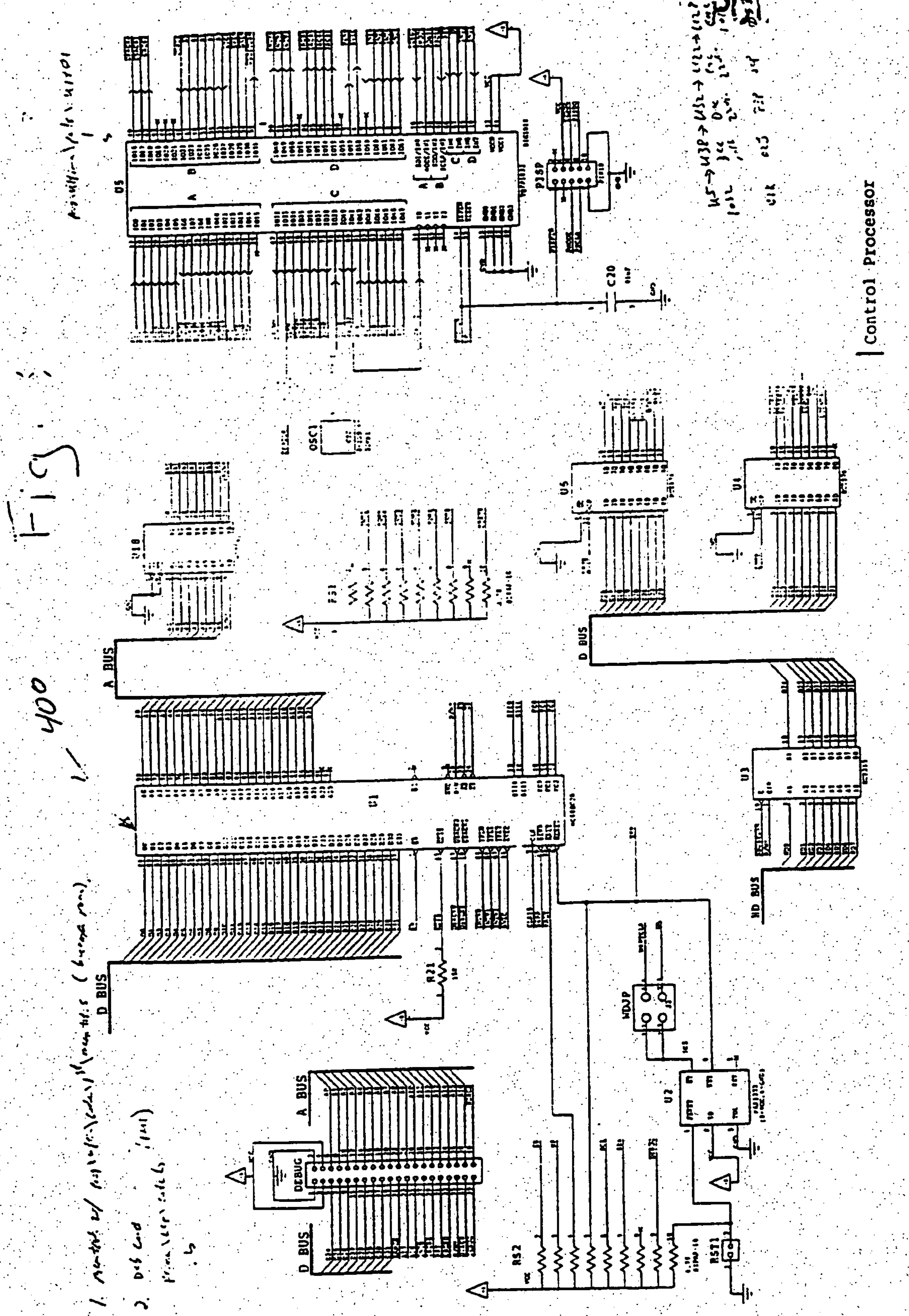
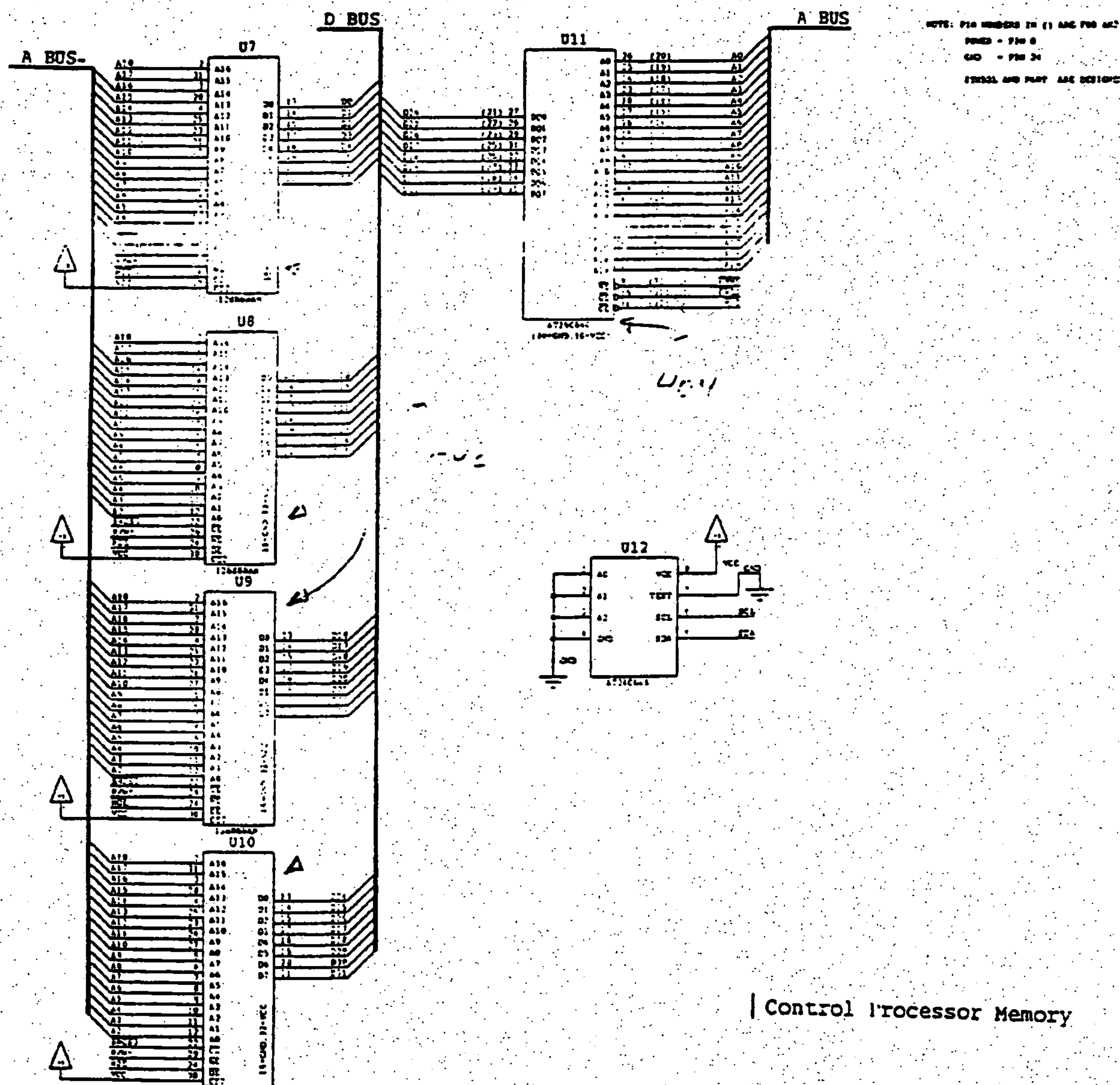

Control Processor
A BUS
D BUS
MD BUS
DEBUG
U1
U2
U3
U4
U5
OSC1
C20
R21
RS1
RS2
WDJP
400

Fig. 9



Control Processor Memory

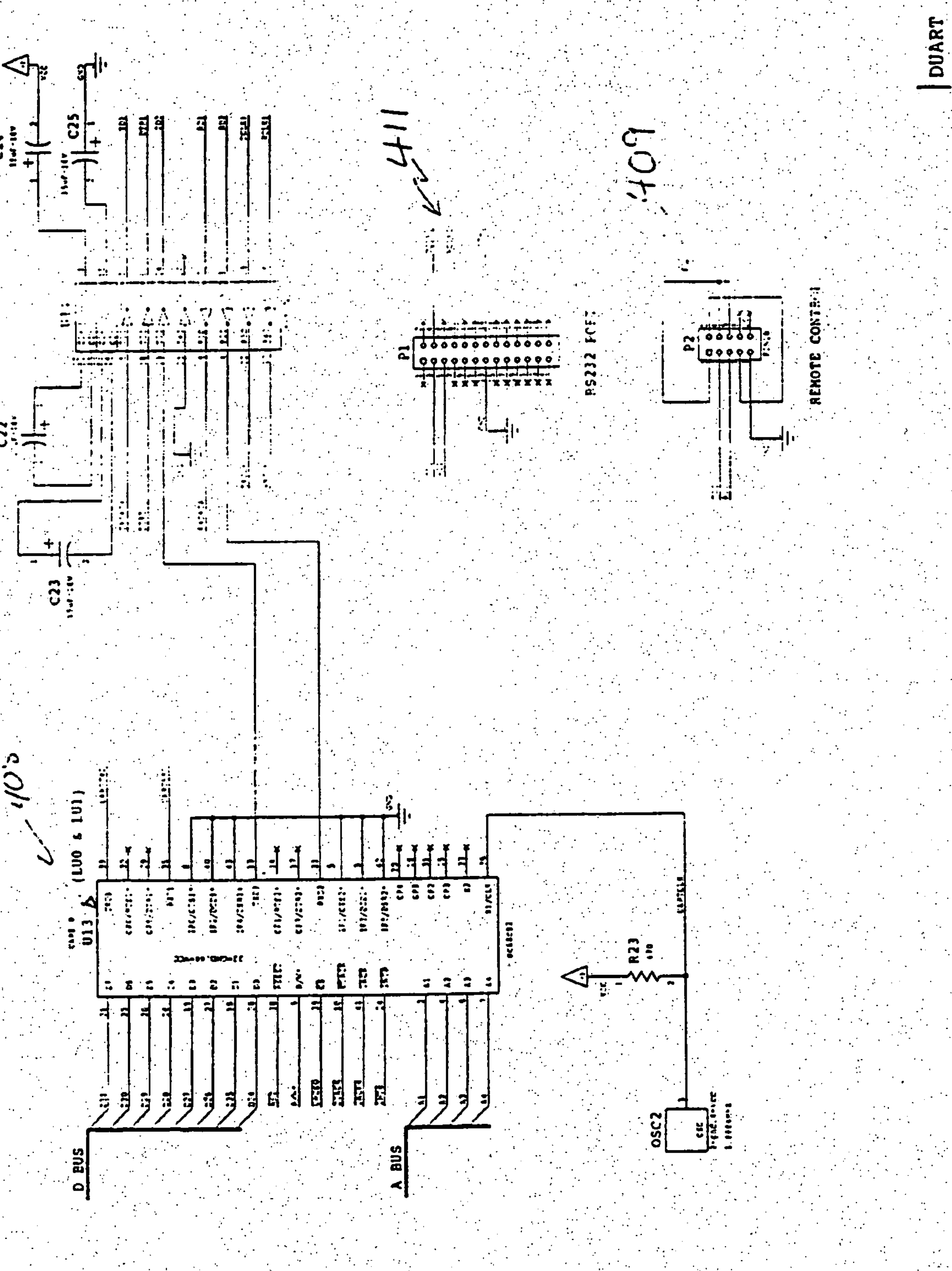
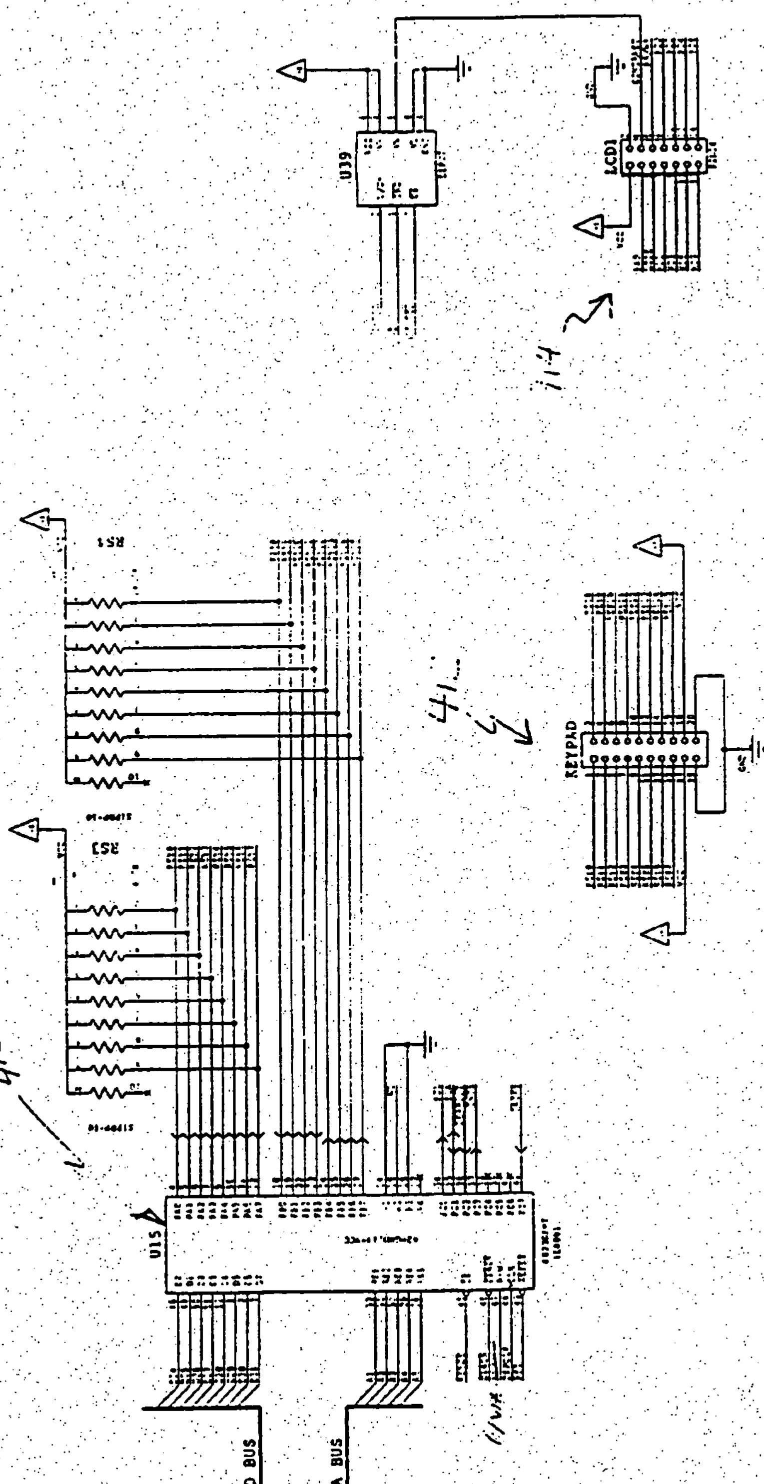

DUART
C24
C25
C22
C23
U13
(LU0 & LU1)
P1
RS232 PORT
P2
REMOTE CONTROL
R23
OSC2
D BUS
A BUS
411
409
405

Fig. 10

Fig. 11



PIT

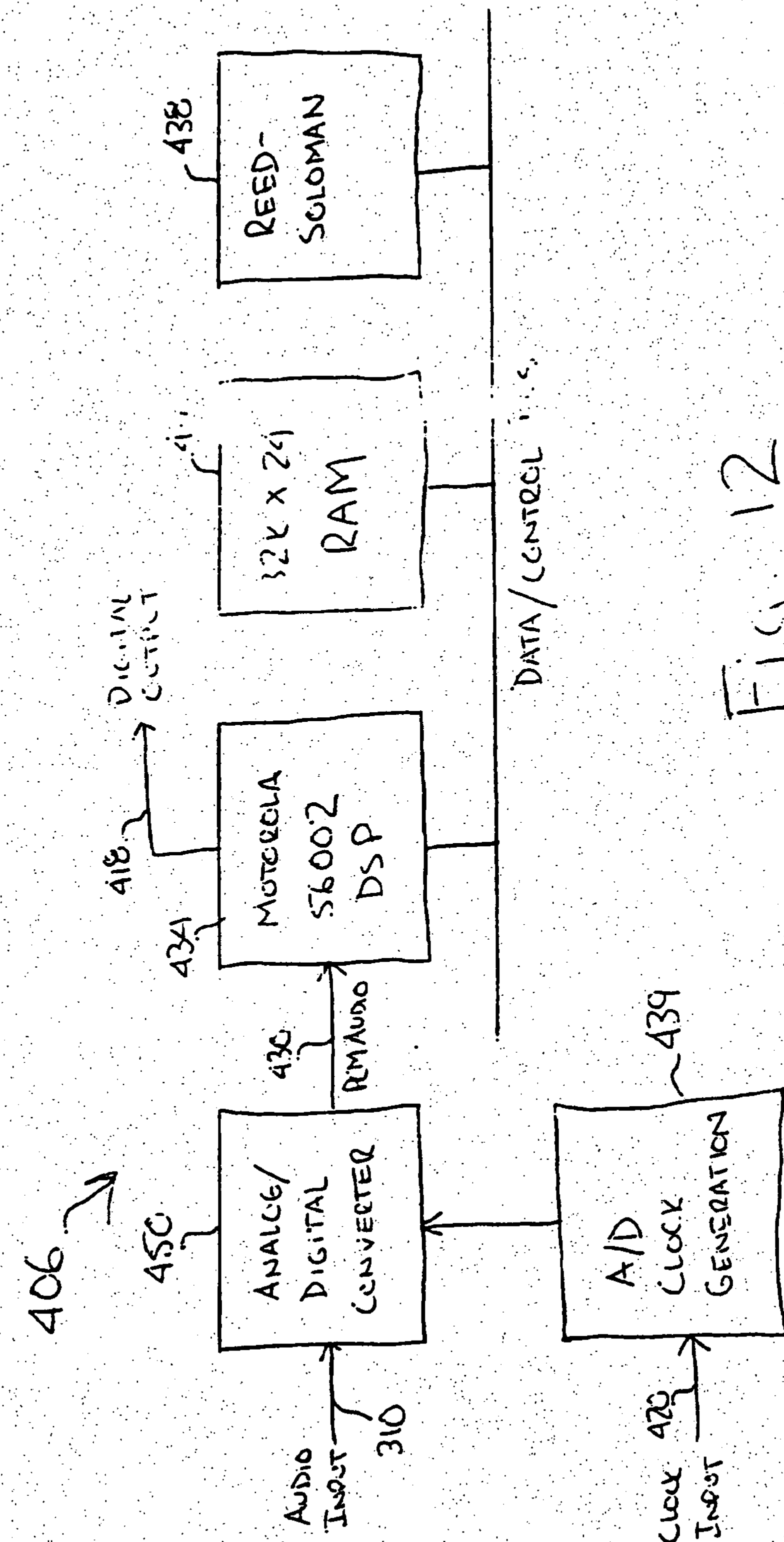

REED-SOLOMAN
438
32K x 24 RAM
DATA/CONTROL
MOTOROLA 56002 DSP
434
418
430
ANALOG/DIGITAL CONVERTER
450
406
A/D CLOCK GENERATION
439
AUDIO INPUT
310
CLOCK INPUT
420

FIG. 12

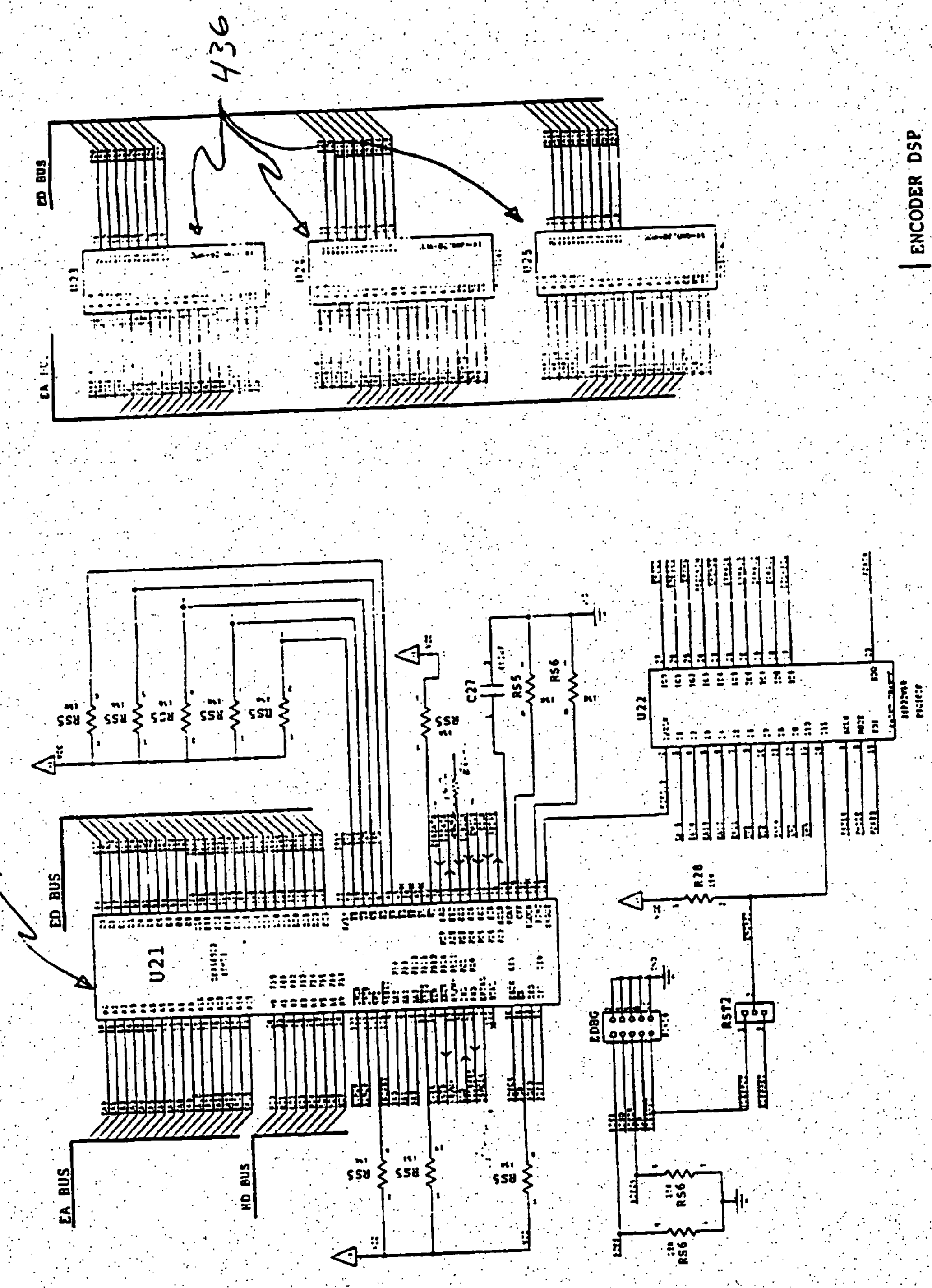
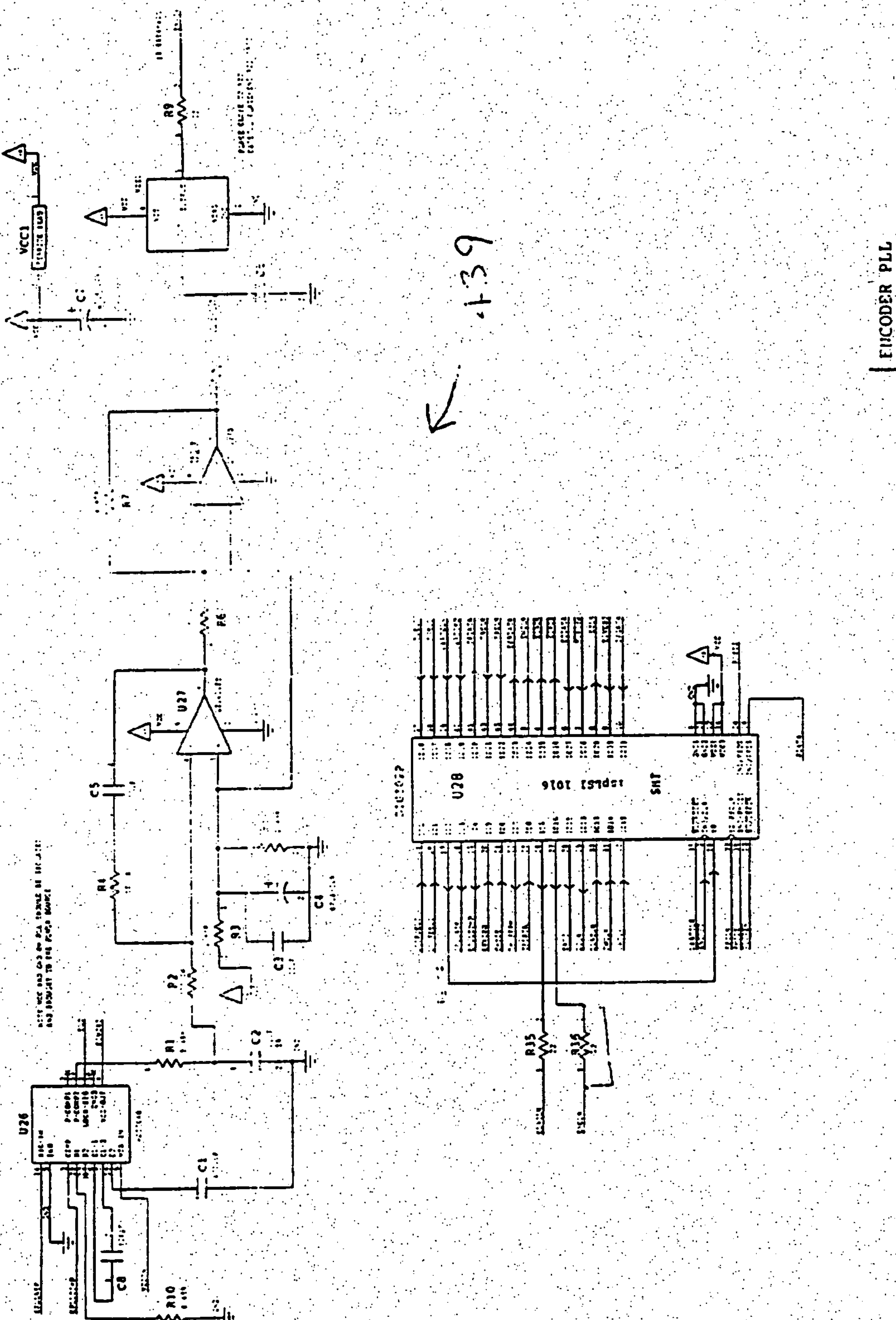

436
ED BUS
EA BUS
U21
434
ED BUS
EA BUS
HD BUS
U22
RS5
RS6
C27
R28
RST2
EDBG
ENCODER DSP

Fig. 13

Fig. 14



BAD ORIGINAL

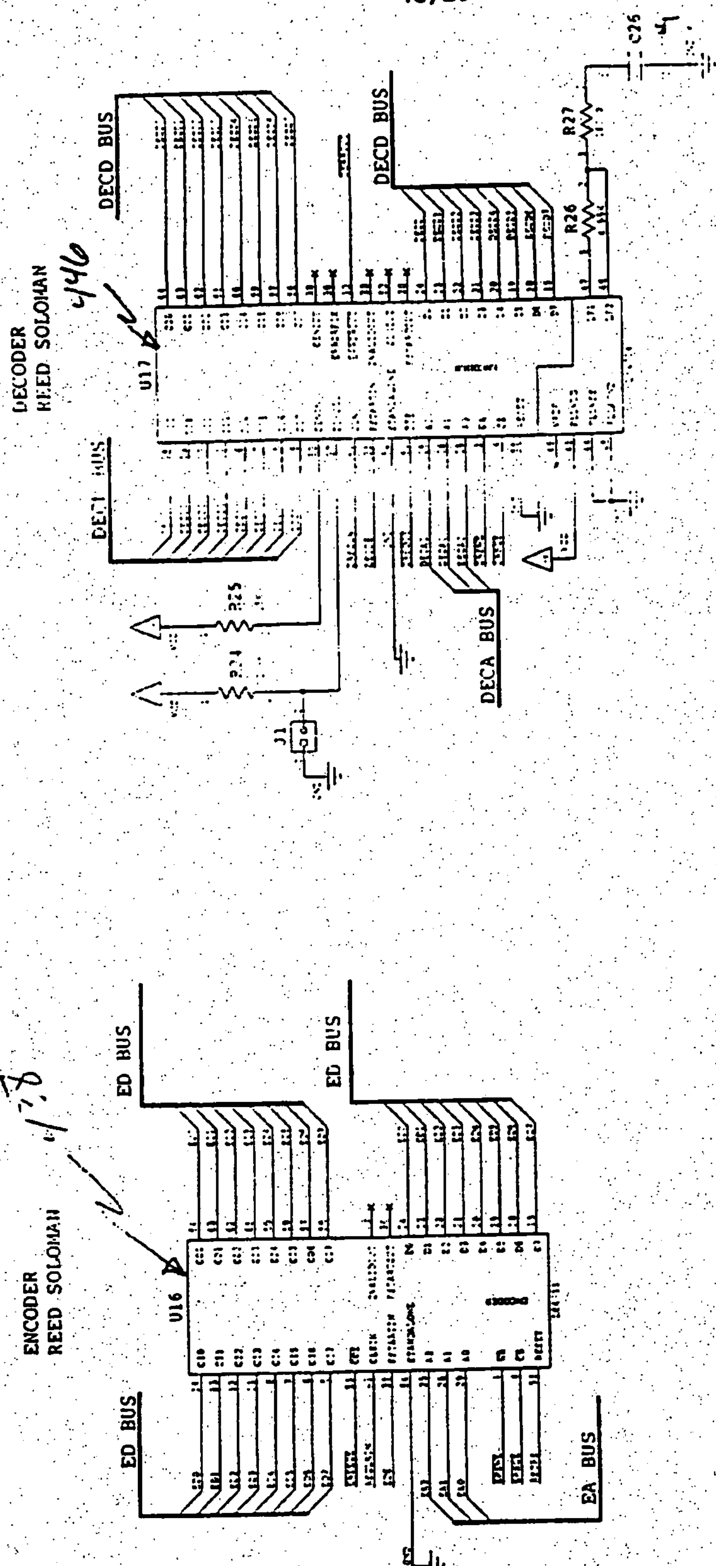


Fig. 15

REED SOLOMAN

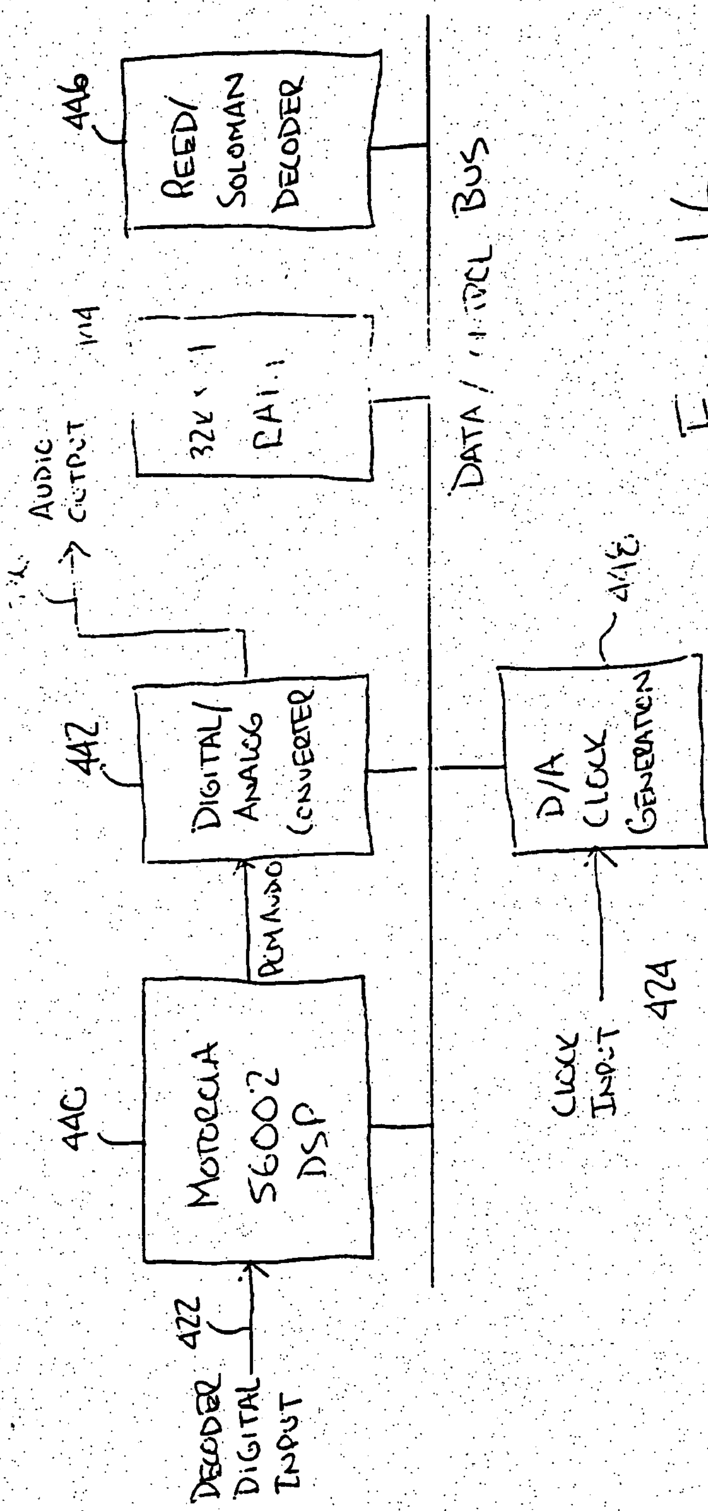

Reed/
Soloman
Decoder
446
Data /
Bus
Audio
Output
Digital/
Analog
Converter
442
D/A
Clock
Generation
Motorola
56002
DSP
440
Decoder
Digital
Input
422
Clock
Input
424

Fig. 16

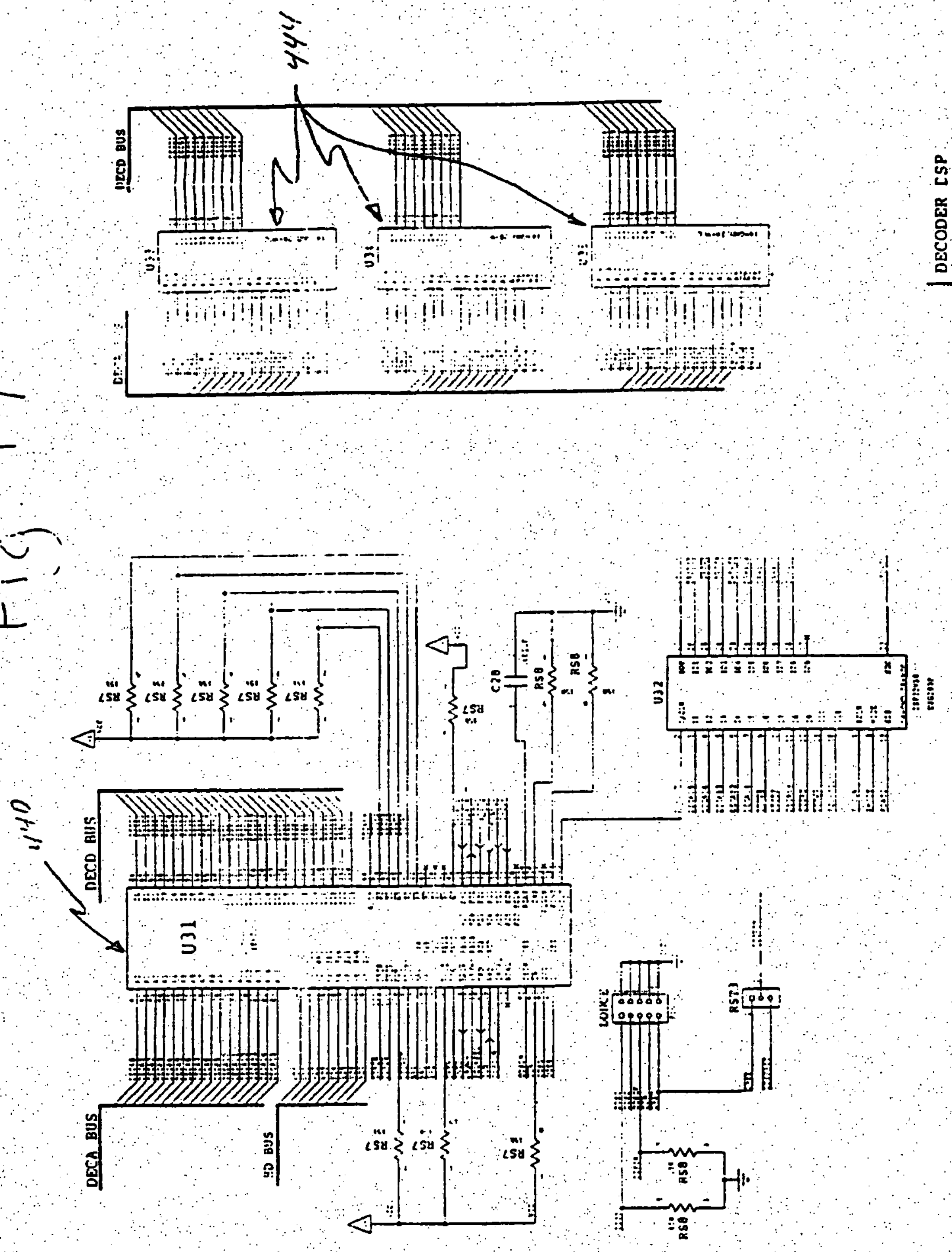

444
DECD BUS
U31
DECODER DSP
440
U31
DECD BUS
DECA BUS
RS7
RS8
C28
U32
RST3

FIG 17

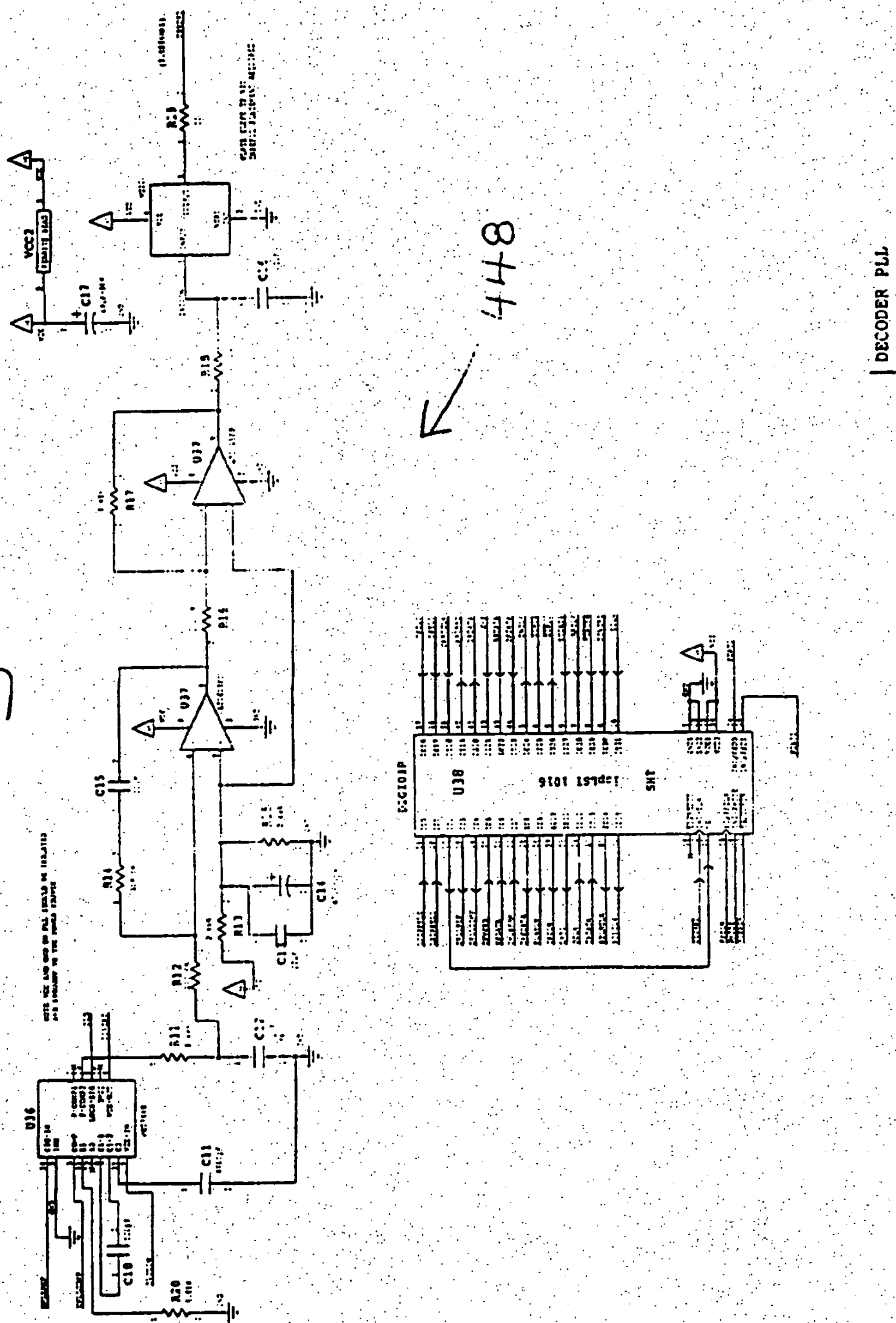
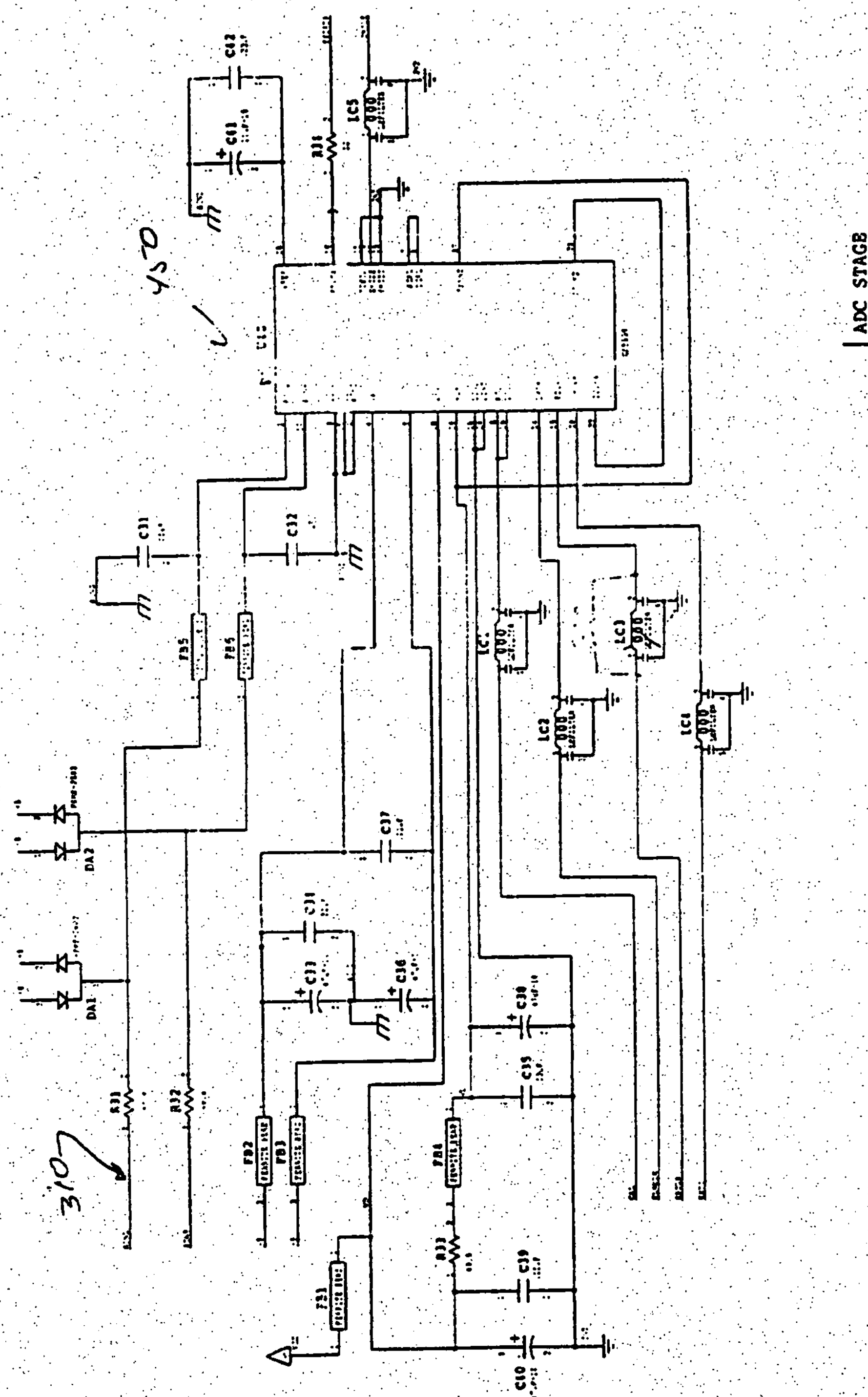

448
DECODER PLL
VCC2
U36
U37
U38
R11
R12
R13
R14
R15
R16
R17
R19
R20
C10
C11
C12
C13
C14
C15
C16
C17

Fig. 18

Fig. 19



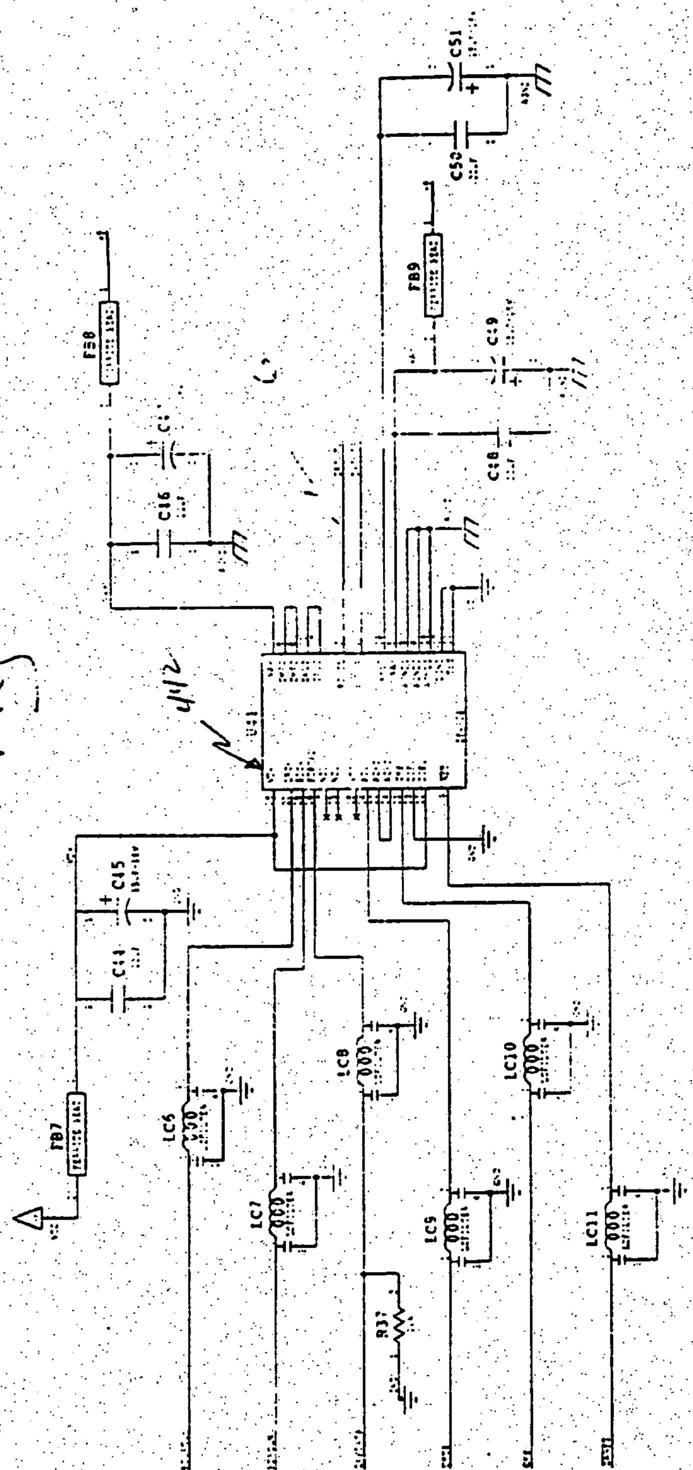


Fig. 20

DAC STAGE

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/04835

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04M 11/00
US CL :379/93
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/93, 90, 98, 101

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,325,423 (LEWIS) 28 JUNE 1994, col. 1, lines 31-44, 49-51; col. 8, lines 52-64; col. 9, lines 5-68.	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 JULY 1996	24 JUL 1996

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